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Late fertility in Italy: exploring regional differentials in a lowest low fertility country

1. Introduction

This study aims to describe the fertility dynamics occurred in Italy and in its divisions and regions in terms of changes of the reproductive behaviour at old age. Firstly we shall define the trend of the reproductive behaviour occurred in Italy and in the other European countries; secondly we shall evaluate the distinctiveness of the Italian case. The analysis will be carried out through a decomposition model that will help us to identify clearly, using a period approach, the effects of the quantum and tempo of fertility on the general process of fertility ageing. Afterwards, the decomposition results will be synthesized through a multiway analysis in order to point out in a homogeneous regional context the distinctive territorial trends.

2. Reproductive behaviour and late fertility

2.1. Reference framework

Since 1970s the changes occurred in the family formation and reproductive behaviour patterns across Europe have shown new and unforeseen demographic dynamics. Many European countries have chosen new familiar forms; the fertility has decreased below the replacement level, the mean age at childbearing has decreased and then increased caused firstly by the fertility fall and then by the increase of the mean age at first birth. Recently the Italian values of the period fertility have fluctuated between 1.25 and 1.30 children per woman. The fall of period fertility is accompanied by a constant fall of cohort completed fertility and the dynamics of fertility intensity is accompanied by strong changes of its timing. By adopting either a period perspective or a cohort one it emerges clearly the increase of the proportion of fertility realized at age 30 an over. Since 1970s onwards, women and couples have postponed childbearing, adopting new and -not completely understood - reproductive models. The mean age at childbearing has increased in each European country with higher values in the Western Europe.
There have been many interpretations of these changes. Socio-economic factors - according to the New Home Economics theory (Becker, 1981), to the opportunity-costs of an increasing participation of woman in the labour market, to her role within the family - and ideational factors - according to the possible change of values and preferences - have

been often considered the causes of the changes occurred in the reproductive and family formation behaviour.
Some authors thought a Second Demographic Transition occurred (Lesthaeghe and van de Kaa, 1986; van de Kaa, 1987) where the family core is the wellbeing of the couple relationship (Lesthaeghe, 1995) opposing the *child-oriented* family of Ariès (1980). These changes, occurred initially in some European countries, would have involved all the European context in time. From this perspective, van de Kaa stated the Second Demographic Transition theory that might be described as a sequence of changes which characterize the family formation process and that it would be displayed in all European countries in time (van de Kaa, 1987).
Twenty years after the formulation of the Second Demographic Transition theory it is possible to admit that changes in the European family formation and reproductive behaviour process developed along two similar trajectories. In terms of fertility, these changes mean "less children and late". However, the European countries have still preserved their own specific quality in the demographic dynamics; this specific quality is found in the different associations and interdependences among the possible determinants of the family formation and reproductive behaviour. See for example the different levels of fertility found in some North-European and South-European countries, in particular in Italy and Spain. The North-European countries, pioneers of the Second Demographic Transition, have recorded the highest fertility levels whereas, Italy and Spain have been enclosed in the lowest-low fertility countries group (see the definition of *lowest-low fertility* in Kohler et al., 2002; Billari and Kohler, 2004). This result would be surprising for what has been pointed out by the first formulation of the Second Demographic Transition where a positive relation would exist between the transition progress and the fertility decline.
The emergence of lowest-low fertility suggests an only partial recovery of delayed childbearing passing from the postponement to the giving up. The late fertility has thus become crucial in the analysis of the changes of reproductive behaviour in terms of different fertility timing and also of its consequences on the fertility intensity.

2.2. The Italian context

The continuous fall of fertility, observed in most of the European countries for decades, has raised important topics in the research on fertility trends. Apart from the analysis of the determinants of the decline, the analysis of fertility ageing has gained in importance (see Bosveld, 1996). By using the proportion of fertility realized at age 30+ as a rough indicator of the late fertility and by adopting a period perspective, we observe since the mid-1970s in many European countries an increasing trend of the late fertility. In Sweden the proportion of fertility realized at age 30+ doubled from 24.6% in 1975 to 48.1% in 2000; in Denmark it rose from 21.7% in 1975 to 47.1% in 2000. Recently the phenomenon has been observed in the Centre-Eastern Europe too (Sobotka, 2004).
In such a context, Italy, a lowest-low fertility country with an increasing proportion of fertility realized at age 30+, represents an interesting example both for its national dynamics and the regional specificities (Santini, 1995).
In Italy during the period 1955-2000 the proportion of fertility realized at age 30+ decreased first, till the end of 1970s, and then it increased clearly from 1980 (Tab. 1). The level rose from 43.6% in 1955 to 53.7% in 2000, reaching the minimum of 29.9% by the end of 1970s and the beginning of the 1980s.
This trend, first decreasing and the increasing, can be also observed in the three Italian divisions, North, Centre and South, with some differences in terms of levels and evolution

in time. At first, the Centre and North levels were lower than the South ones, contrary to what occurred in the first half of the 1980s. In 1955 the North and Centre levels were of 41.8% and 37.8%, whereas the South regions recorded levels of 48.1%. At the end of the mentioned period the proportion of fertility realized at age 30+ in the North and Centre regions reached levels of 58.1% and 59.1%, whereas the South levels were of 47.5%. For what concerns the recovery times of the proportion of fertility realized at age 30+, the North regions recorded the minimum around the mid-1970s, whereas the Centre and South regions recorded the indicator increase by the end of 1970s and the beginning of 1980s.

Table 1 – *Proportion of fertility realized at age 30+: divisions and Italy*

	1955	1960	1965	1970	1975	1980	1985	1990	1995	2000
North	41.8	38.8	35.5	32.7	29.0	29.6	36.2	44.6	54.2	58.1
Centre	37.8	35.8	34.5	32.1	28.9	28.2	34.4	42.6	52.4	59.1
South	48.1	45.0	42.8	40.2	35.7	32.3	33.3	36.1	41.5	47.5
Italy	43.6	40.8	38.3	35.5	31.4	29.9	33.8	40.1	48.0	53.7

Source: own elaboration on Istat data

However, the analysis of the trend of the proportion of fertility realized at age 30+ does not show the actual dynamics of the late fertility, hence it cannot highlight the real changes of the reproductive behaviour at 30+.
In fact, to the increase of the proportion of fertility realized at age 30+ in a period perspective does not correspond necessarily an increase of fertility realized at age 30+. In Italy the increase of the proportion of fertility realized at age 30+ was due to the dynamics of the fertility at younger ages, till 1990 in the South regions and till 1980 in the North ones (Giorgi, 1995). Apart from the obvious role of the period calendar dynamics on the proportion of fertility realized at age 30+, the birth order dynamics is also important and acts because the fertility calendar by birth order is different. So, changes of the structure by birth order, even when there are no changes in the timing for each single order, cause changes of the overall fertility calendar. In particular, the increase of the proportion of first births can lead to a decrease of fertility realized at age 30+ even when there are no real changes of fertility calendar by birth order.
Before carrying on the analysis of late fertility, we must first better define what is intended as late fertility, the approaches generally required for studying this phenomenon and in particular those proposed in this study.

2.3. Definition, methods and data

From an individual point of view, adopting the life course perspective, the late fertility might be described as that part of the reproductive process realized at age 30+. From a macro point of view, major attention should be paid at the concept of late fertility and the methodology required for its analysis, depending on whether a period or cohort perspective is used.
The proportion of fertility realized at age 30+ is generally used as indicator in the analysis of late fertility. However, in a period perspective, this indicator can lead to a wrong interpretation of the dynamics as it hides the changes of intensity and timing of fertility , also of longitudinal nature. Hence, at a macro level analysis, it is important to proceed with a longitudinal approach or use methods that allow us to split the different components of the trend of this synthetic indicator. In particular, here it is necessary to distinguish

between changes of fertility calendar and intensity pointing out the merely mechanic relationship that links these two phenomena in a period perspective.
This study aims to explain the trend of the late fertility in the Italian regional context by using methods that allow us to overcome the limits of the used indicator. If the aim was to identify the real changes of the reproductive behaviour, even only over the age of 30, the probabilities specific by age and parity would be the more suitable measure. The decomposition model could be an alternative tool if we consider the classic literature and available age and order-specific fertility rates (also known as reduced rates, incidence rates). This model may distinguish the effects of the different components on the evolution of the proportion of fertility realized at age 30+.
Afterwards, in order to detect synthetically the differences and common factors existing among the Italian regions in time as regards the effect of the different components considered in the model on late fertility dynamics, we have used a multivariate statistical analysis, that is the multiway factor analysis.
Istat supplied the age and order specific fertility rates for the twenty Italian regions available for the period 1955-2000.

3. A decomposition model used for analysing the late fertility

As said before for the demographic (mechanic) determinants of the development of the phenomenon, after the baby boom years the late fertility fall was due to the decrease of fertility at higher birth orders. Hence, we want to express clearly the role of two important variables such as age and birth order. We shall here use a decomposition model with additive effects with a classic structure of single, aggregated, interaction and total effects (Kitagawa, 1955; Das Gupta, 1978). The decomposition model aims to analyse the variation of the proportion of fertility occurred at age 30+.

3.1. Model description

The above mentioned model will be used to factorize the variation of the proportion of fertility realized at older ages:

$$\Delta\frac{TFR_{30+}}{TFR}=\left(\frac{TFR^{*}_{30+}}{TFR^{*}}-\frac{TFR_{30+}}{TFR}\right)=\frac{TFR\cdot TFR^{*}_{30+}-TFR^{*}\cdot TFR_{30+}}{TFR^{*}\cdot TFR}$$

We define Δx the variation of x and $\Delta(x)$ the variation due to x of the decomposition variable; by intuition $\Delta(x,y)$ will be the aggregated variation due to x and y. We define $I(x,y)$ the double interaction due to x and y and in a similar manner the interactions of higher order. Finally we define $\Delta_2(x)$ the single variation and of double interaction due to x, $\Delta_3(x)$ is the single variation and of triple and double interaction due to x, and $\Delta_{tot}(x)$ is the single variation and of total interaction due to x, that is, for each variable, the final result of the model. The general relations of interactions and of the single effects and interactions, in case of variable x, will be:

$$I(x,y)=\Delta(x,y)-\Delta(x)-\Delta(y)$$

$$\Delta_2(x) = \Delta(x) + \frac{1}{2}\left(I(x,y) + I(x,z) + I(x,k)\right)$$

$$I(x,y,z) = \Delta(x,y,z) - \Delta_2(x) - \Delta_2(y) - \Delta_2(z)$$

$$\Delta_3(x) = \Delta_2(x) + \frac{1}{3}\left(I(x,y,z) + I(x,y,k) + I(x,z,k)\right)$$

$$I(x,y,z,k) = \Delta(x,y,z,k) - \Delta_3(x) - \Delta_3(y) - \Delta_3(z) - \Delta_3(k)$$

$$\Delta_{tot}(x) = \Delta_3(x) + \frac{1}{4} I(x,y,z,k)$$

In terms of total variation of late fertility, this quantity will be factorized in effects connected to the variation of fertility of first order realized at age 15-29 and 30+ and those connected to the variation of fertility of higher order realized at age 15-29 and 30+. The single absolute effects will be:

$$\Delta\left(TFR^{I}_{15-29}\right) = \frac{-\Delta TFR^{I}_{15-29} \cdot TFR_{30+}}{TFR \cdot \left(TFR + \Delta TFR^{I}_{15-29}\right)}$$

$$\Delta\left(TFR^{II}_{15-29}\right) = \frac{-\Delta TFR^{II}_{15-29} \cdot TFR_{30+}}{TFR \cdot \left(TFR + \Delta TFR^{II}_{15-29}\right)}$$

$$\Delta\left(TFR^{I}_{30+}\right) = \frac{\Delta TFR^{I}_{30+} \cdot TFR_{15-29}}{TFR \cdot \left(TFR + \Delta TFR^{I}_{30+}\right)}$$

$$\Delta\left(TFR^{II}_{30+}\right) = \frac{\Delta TFR^{II}_{30+} \cdot TFR_{15-29}}{TFR \cdot \left(TFR + \Delta TFR^{II}_{30+}\right)}$$

As an example the double absolute effects will be:

$$\Delta\left(TFR^{I}_{15-29}, TFR^{II}_{15-29}\right) = \frac{-TFR_{30+} \cdot \left(\Delta TFR^{I}_{15-29} + \Delta TFR^{II}_{15-29}\right)}{TFR \cdot \left(TFR + \Delta TFR^{I}_{15-29} + \Delta TFR^{II}_{15-29}\right)}$$

or:

$$\Delta\left(TFR^{I}_{15-29}, TFR^{I}_{30+}\right) = \frac{TFR_{15-29} \cdot \Delta TFR^{I}_{30+} - TFR_{30+} \cdot \Delta TFR^{I}_{15-29}}{TFR \cdot \left(TFR + \Delta TFR^{I}_{15-29} + \Delta TFR^{I}_{30+}\right)}$$

The triple absolute effects will be:

$$\Delta\left(TFR^{I}_{15-29}, TFR^{II}_{15-29}, TFR^{I}_{30+}\right) = \frac{TFR_{15-29} \cdot \Delta TFR^{I}_{30+} - TFR_{30+} \cdot \left(\Delta TFR^{I}_{15-29} + \Delta TFR^{II}_{15-29}\right)}{TFR \cdot \left(TFR + \Delta TFR^{I}_{15-29} + \Delta TFR^{II}_{15-29} + \Delta TFR^{I}_{30+}\right)}$$

or:

$$\Delta\left(TFR^{I}_{15-29}, TFR^{I}_{30+}, TFR^{II}_{30+}\right) = \frac{TFR_{15-29} \cdot \left(\Delta TFR^{I}_{30+} + \Delta TFR^{II}_{30+}\right) - TFR_{30+} \cdot \Delta TFR^{I}_{15-29}}{TFR \cdot \left(TFR + \Delta TFR^{I}_{15-29} + \Delta TFR^{I}_{30+} + \Delta TFR^{II}_{30+}\right)}$$

See the Appendix for the details of triple and double effects.
The interactions and the overall effects can be obtained using these quantities and the general relations as shown before. For brevity purposes these relations are not reported here.
The decomposition model allows us to identify all these aspects for each region and it should help us to understand if recently the dynamics of the total fertility, that is this mechanic game linked to the fall, continue to have an important role in the rise of late fertility or give space to a real aging of the fertility processes.
In terms of $\Delta_{tot}\left(TFR^{I}_{15-29}\right)$ and $\Delta_{tot}\left(TFR^{II}_{15-29}\right)$ effects, *the positive sign of the model parameters is linked to a decrease of fertility at age 15-29.* In terms of $\Delta_{tot}\left(TFR^{I}_{30+}\right)$ and $\Delta_{tot}\left(TFR^{II}_{30+}\right)$ effects, *the positive sign of the model parameters is linked to an increase of fertility at age 30+.*

3.2. Results

Taking into consideration Italy (see Tab. 2) and the model results from different points of view, being additive, we detect that during the fall of the proportion of fertility realized at older ages till the end of the 1970s, an important role is played, as revealed in advance, by the fall of fertility at age 30+ and in particular by the fertility of second and higher birth orders (see the parameters values of -8.44, -13.79 and -19.63 during 1965-1980). Note that the two points of view are strictly linked. Naturally, the fall of fertility in the age class 15-29 would curb the decline of late fertility. Since 1975 onwards the effect of fertility in the age class 15-29 becomes manifest as it begins to oppose the effect of fertility at age 30+ and of higher orders causing an increase of the proportion of fertility realized at older ages from 1980 onwards (see the high positive values of 9.38 and 9.14 during 1975-1985). Since the second half of 1980s starts, on the Italian total, a positive effect of the fertility realized at age 30+; from this period onwards a similar process in the reproductive behaviours corresponds to the growth of the proportion of fertility at older ages and there is also an increase of fertility at age 30+ (not only of its weight on the total). See the positive values of the aggregated effects equal to 8.62, 3.15, 8.48 during 1985-2000.
In terms of Italian total we see a more relevant weight on the variation of the indicator of fertility of the second and higher birth orders. In particular this effect is more incisive in the five-year periods 1965-70, 1970-75 and 1975-80. In fact, the variation of fertility from the second and higher birth orders at age 30+ decreased the proportion of fertility realized at age 30+ respectively of 8.44%, 13.79% and 19.63%.
A greater importance of the lower birth orders and the fertility at ages under 30 is noticed from 1975 (+9.38%), but in the following years the effects of these variations became predominant till 1995. During 1995-2000 the role of the variation of fertility at age 30+

became again more obvious due to the progress of fertility postponement. In fact, as the fertility at age 30+ increases even, when there are no changes of the structure by birth order, we claim that there is a shift of births of first and second order from the age class 15-29 to 30+.

Table 2 – *Model results: Italy*

	1955	1960	1965	1970	1975	1980	1985	1990	1995	2000
%TFR 30+	43.59	40.83	38.35	35.54	31.36	29.94	33.80	40.06	47.99	53.73

	1955-60	1960-65	1965-70	1970-75	1975-80	1980-85	1985-90	1990-95	1995-00
var %TFR 30+	-6.32	-6.09	-7.32	-11.74	-4.54	12.90	18.52	19.79	11.95
Single effects									
TFR I 15-29	-2.85	-4.15	1.92	-1.21	9.38	9.14	2.76	8.54	-0.08
TFR I 30+	0.56	0.59	-1.95	0.01	-2.20	1.52	4.87	4.91	4.98
TFR II 15-29	-1.24	-4.27	1.15	3.24	7.91	6.69	7.14	8.10	3.55
TFR II 30+	-2.79	1.75	-8.44	-13.79	-19.63	-4.46	3.75	-1.76	3.50
Aggregated effects									
TFR I	-2.29	-3.57	-0.04	-1.20	7.18	10.67	7.63	13.45	4.90
TFR II	-4.03	-2.52	-7.29	-10.55	-11.72	2.23	10.89	6.35	7.05
TFR 15-29	-4.09	-8.43	3.07	2.04	17.29	15.84	9.90	16.64	3.46
TFR 30+	-2.23	2.34	-10.39	-13.78	-21.83	-2.94	8.62	3.15	8.48

Table 3 illustrates the particular geography of the Italian fertility from a divisions point of view. The North and Centre regions seem to have a different evolution with respect to the South regions. At first sight the different evolution seems due to a time lag that splits the South from the rest of the country but through an accurate analysis the things seem different: the Centre shows distinctive trends too. In the mid-1950s the South shows the higher fertility at older ages because of the higher weight of the higher birth orders. Since 1955 onwards all divisions record the fall of the proportion of fertility at older ages due to the fertility decline at ages under 30, with particular evidence in the North, and to a decrease of second and higher birth orders. During the five-year period 1975-80 there was a reversal and a progressive increase of the fertility at older ages in the North. This increase started in the Centre whereas during the following five-year period 1980-85 it started in the South regions. Even if late, the Centre increase of fertility at older ages occurred with similar rates and higher than those observed in the North. The South increase is less marked than the other divisions. In 2000 the North showed values of 58.1%, the Centre of 59.1% and the South of 47.5%.

The decomposition model helps us to highlight how recently the growth of the late fertility is first of all due to the strong fall of fertility levels and not to the fertility postponement, as the role of fertility at older ages is always poor and, at least up to the first half of 1990s, constantly lower than the effects due to other components. In particular, the fertility at age 30+ had a leading position in the North and Centre regions only during the five-year period 1995-00.

The decomposition model shows also how the role of the Centre parameters is similar to the North ones in terms of the development in time, though with some exceptions of the Centre that curb this trend by the end of 1970s (see Umbria, Marche and Lazio compared to Toscana). The South diversity seems being synthesized by the opposite role of fertility at age 30+. This is followed by a distinctive mix of effects by order and age that would indicate the presence of different dynamics, and thus of different reproductive models, rather than the presence of a simple time lag in the evolution of the phenomenon. In

particular, this fact would be corroborated by the important role of fertility at ages under 30 and by the components related to the second and higher birth orders.
Even if the model does not show in detail the second and higher birth orders, by analysing directly the values of age and order-specific fertility rates, we detect apart from the role of the first order, a slow increase of the second order in the North and Centre regions, even without changes of the third and higher birth order. The decomposition model parameters show us for the five-year period 1970-75 a prevailing negative effect of fertility of second and higher birth orders at age 30+ on levels similar in the three divisions. In the following five-year period this effect remains negative and becomes stronger in all divisions. In the North and Centre regions this effect is accompanied by a positive effect of fertility at ages under 30, whereas the effect is still marginal in the South regions. However, also the divisions seem hide, as already observed for Italy, different realities.

In the second half of the 1990s, the North regions recorded an interruption of the fall of fertility and a widespread renewal in the age class 15-29. This process was highlighted by the model in the five-year period 1995-00 when the parameters related to TFR I_{15-29} and TFR II_{15-29} had a negative sign.

Table 3 – *Model results: Italian divisions*

North	1955	1960	1965	1970	1975	1980	1985	1990	1995	2000
%TFR 30+	41.76	38.78	35.47	32.71	29.02	29.63	36.21	44.61	54.16	58.05

	1955-60	1960-65	1965-70	1970-75	1975-80	1980-85	1985-90	1990-95	1995-00
var %TFR 30+	-7.14	-8.52	-7.78	-11.30	2.12	22.20	23.21	21.41	7.19
Single effects									
TFR I 15-29	-4.55	-6.07	2.16	-0.43	14.78	10.87	6.54	8.42	-2.04
TFR I 30+	0.75	0.77	-2.50	-2.09	-1.28	3.66	5.76	6.18	5.32
TFR II 15-29	-2.59	-7.73	0.88	3.72	11.29	7.69	5.39	5.71	0.26
TFR II 30+	-0.75	4.51	-8.32	-12.50	-22.67	-0.02	5.52	1.09	3.66
Aggregated effects									
TFR I	-3.80	-5.30	-0.34	-2.51	13.50	14.53	12.30	14.61	3.27
TFR II	-3.35	-3.22	-7.44	-8.78	-11.38	7.67	10.91	6.80	3.92
TFR 15-29	-7.14	-13.80	3.04	3.29	26.06	18.56	11.92	14.13	-1.78
TFR 30+	0.00	5.28	-10.82	-14.59	-23.95	3.64	11.29	7.27	8.97

Centre	1955	1960	1965	1970	1975	1980	1985	1990	1995	2000
%TFR 30+	37.76	35.78	34.47	32.09	28.86	28.19	34.40	42.56	52.35	59.07

	1955-60	1960-65	1965-70	1970-75	1975-80	1980-85	1985-90	1990-95	1995-00
var %TFR 30+	-5.22	-3.68	-6.89	-10.09	-2.31	22.04	23.73	22.99	12.83
Single effects									
TFR I 15-29	-2.91	-4.83	2.59	-1.36	11.14	12.44	4.75	10.34	0.37
TFR I 30+	0.00	0.84	-1.73	0.01	-2.73	3.63	6.38	5.34	5.08
TFR II 15-29	-1.48	-5.45	0.87	2.73	9.36	7.79	6.90	7.32	2.90
TFR II 30+	-0.84	5.76	-8.62	-11.46	-20.09	-1.82	5.70	-0.01	4.48
Aggregated effects									
TFR I	-2.91	-3.99	0.86	-1.35	8.41	16.07	11.13	15.68	5.45
TFR II	-2.31	0.31	-7.75	-8.74	-10.73	5.97	12.60	7.31	7.38
TFR 15-29	-4.38	-10.28	3.46	1.37	20.50	20.22	11.65	17.66	3.27
TFR 30+	-0.84	6.60	-10.35	-11.46	-22.82	1.81	12.08	5.33	9.56

South	1955	1960	1965	1970	1975	1980	1985	1990	1995	2000
%TFR 30+	48.10	44.97	42.77	40.20	35.69	32.27	33.33	36.12	41.54	47.50

	1955-60	1960-65	1965-70	1970-75	1975-80	1980-85	1985-90	1990-95	1995-00
var %TFR 30+	-6.51	-4.89	-6.00	-11.23	-9.57	3.29	8.36	15.01	14.35
Single effects									
TFR I 15-29	-1.82	-1.21	1.58	-1.67	2.83	6.30	0.68	8.27	1.76
TFR I 30+	0.35	0.00	-1.33	0.01	-0.71	-1.00	3.38	2.64	3.48
TFR II 15-29	-1.54	-2.13	1.26	3.00	6.54	8.48	5.59	10.43	6.93
TFR II 30+	-3.50	-1.55	-7.51	-12.57	-18.24	-10.50	-1.30	-6.33	2.16
Aggregated effects									
TFR I	-1.47	-1.21	0.25	-1.66	2.13	5.31	4.06	10.91	5.25
TFR II	-5.04	-3.68	-6.25	-9.57	-11.70	-2.02	4.30	4.10	9.09
TFR 15-29	-3.36	-3.34	2.84	1.33	9.38	14.78	6.27	18.69	8.69
TFR 30+	-3.15	-1.55	-8.84	-12.57	-18.94	-11.50	2.08	-3.68	5.65

3.3. The multiway factor analysis

The decomposition model results have highlighted the presence of regional differences in the trend of late fertility. In order to synthesize these results and verify if the different dynamics of the late fertility has caused a higher or a lower dispersion of the Italian regions in time, we prose the multiway factor analysis[1]. This method allows to observe the phenomenon changes in time. Furthermore, the regions projection on the factorial plan allows us to study the distinctive characteristics of the regions in the phenomenon trend.
For the twenty Italian regions during 1955-2000 the parameters of the decomposition model (total effect TFR $I_{15\text{-}29}$, total effect TFR $II_{15\text{-}29}$, total effect TFR I_{30+}, total effect TFR II_{30+}) and the proportion of fertility realized at age 30+ ($\%TFR_{30+}$) [2] have been considered as variables of the multiway analysis.
As can be seen in Figure 1, the projection of variables on the factorial plane, through the analysis of their trajectory, sheds light on the dynamics of the late fertility and the change of the role of the decomposition model components in the phenomenon trend. The more clear and interesting result regards the change of the association between the proportion of fertility realized at age 30+ and the variation of fertility below and above age 30. By comparing the beginning and the end of the period, in 1955 we detect that a greater proportion of fertility realized at age 30+ is associated to a minor break (negative sign of the effect in the decomposition model) or greater contribution (positive sign in the decomposition model) of fertility at ages under 30 . In 1995, instead, a greater percentage of fertility realized at age 30+ is linked to the variation of fertility at age 30+. In particular, as shown in the decomposition model, a greater proportion of fertility realized at age 30+ is linked to a positive variation of fertility at age 30+ corroborating the important role of the delayed childbearing, whereas the contribution of the variation of fertility below age 30 decreases.
As can be seen in Figure 2, the projection of regions on the factorial plane shows how the late fertility, that initially characterized the South regions, recorded the highest values in the North and Centre regions at the end of the period. By comparing the two periods we detect in terms of late fertility trend that the effect of the variation of fertility below age 30 is more incisive in the South, whereas in the North it is more linked to the variation of fertility above age 30.
It seems useful to focus on the middle years results. Through the analysis of the trajectory of the model parameters, we can focus on the dynamics of the phenomenon and show how the effect of the variation of fertility by age and birth order n the proportion of fertility realized at age 30+ and of the associations among the parameters of the model themselves have changed in time.
After the baby-boom years, the first changes occurred in 1965: a greater proportion of fertility realized at age 30+ is linked to higher levels (in algebraic value) of the variation of fertility of the second and higher birth orders below age 30 and of the fertility of first order at older ages. In particular, also through the decomposition model results, we detect that to a higher proportion of fertility realized at age 30+ correspond a less prominent effect of the fall of first order fertility at age 30+ (as this fertility is anyway of minor intensity) and a more significant effect of the fall of fertility at ages under 30 of the higher birth orders, besides the clear effect of the fall of fertility of order II+ at age 30+. In this case the projection of the regions on the factorial plane does not show a net territorial division as

[1] The analysis has been performed by the ACT-STATIS package (Lavit, 1988).
[2] In 1955 and 1960 the same fertility rates have been considered for Abruzzo and Molise in order to calculate the proportion of fertility realized at age 30+ and the parameters of the decomposition model.

regards the phenomenon trend and, over all, the classic division between North and South regions does not come out.
In 1975, the opposite role of the variation of fertility below and above 30 is clear. The proportion of fertility realized at age 30+ is higher where the effect of the variation of fertility at age 30+ records the higher levels (in algebraic value), whereas the effect of the variation of fertility at younger ages shows lower levels. In terms of the model results, this is referred to the case where the role of the fall of fertility below and above 30 is lower than in other regions. Here, the opposition between the North-Centre and the South is clearer, besides, the South regions are still characterized by higher levels of the proportion of fertility realized at age 30+.
From the five-year period 1985-1990 it seems the meaning of late fertility itself has changed and its higher levels are recorded in the North and in the Centre. In addition to it, during the following two five-year periods the role of the increase of fertility at age 30+ on the rise of the proportion of fertility realized at age 30+ appears clearly.
In 1995, in fact, the phenomenon of delayed childbearing, that is the crucial role of the variation of fertility at 30+, contributes to the increase of the proportion of fertility realized at age 30+ in the North. On the other hand, the contribution of the variation of fertility at ages under 30 reduces and, as confirmed by the decomposition model, assumes again a break role, at least in the North regions. In the South the variation of fertility at ages under 30 has a greater role contributing to the increase of the proportion of fertility at age 30+, whereas the delayed childbearing is not as clear as in the North.
The multiway model results suggest the presence of a persistent difference among the Italian regions as regards late fertility dynamics. In fact, it seems that the dynamics of the phenomenon has not led to a greater regional homogeneity in time. In reality, the convergence process seems occur in the single divisions and not nationally. At the end of the observation period it is confirmed the presence of two more homogeneous groups of regions: on the one hand the South, on the other hand the North and Centre.
This result supports the decomposition model conclusions, according to which the differences among the Italian divisions would not be caused only by a time lag in the phenomenon evolution (in this case we should observe a similar trajectory for the North and South regions) but it also would show the presence of different dynamics, caused presumably by different reproductive models, that facilitate the increase of the national variability, in particular between the North-Centre and the South.

Figure 1 – *Multiway factor analysis. Projection of the decomposition model parameters on the factorial plane. Various years*

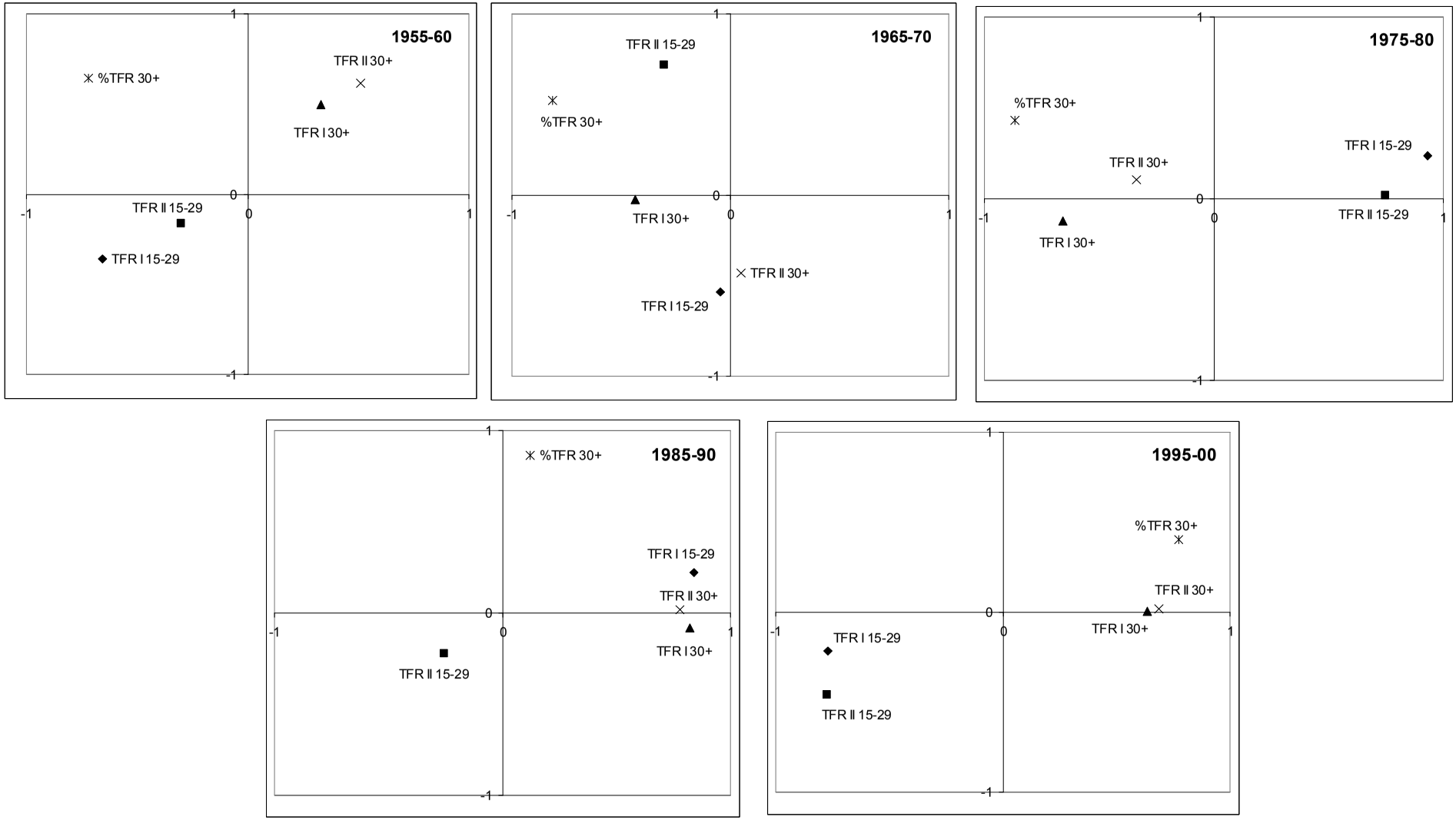
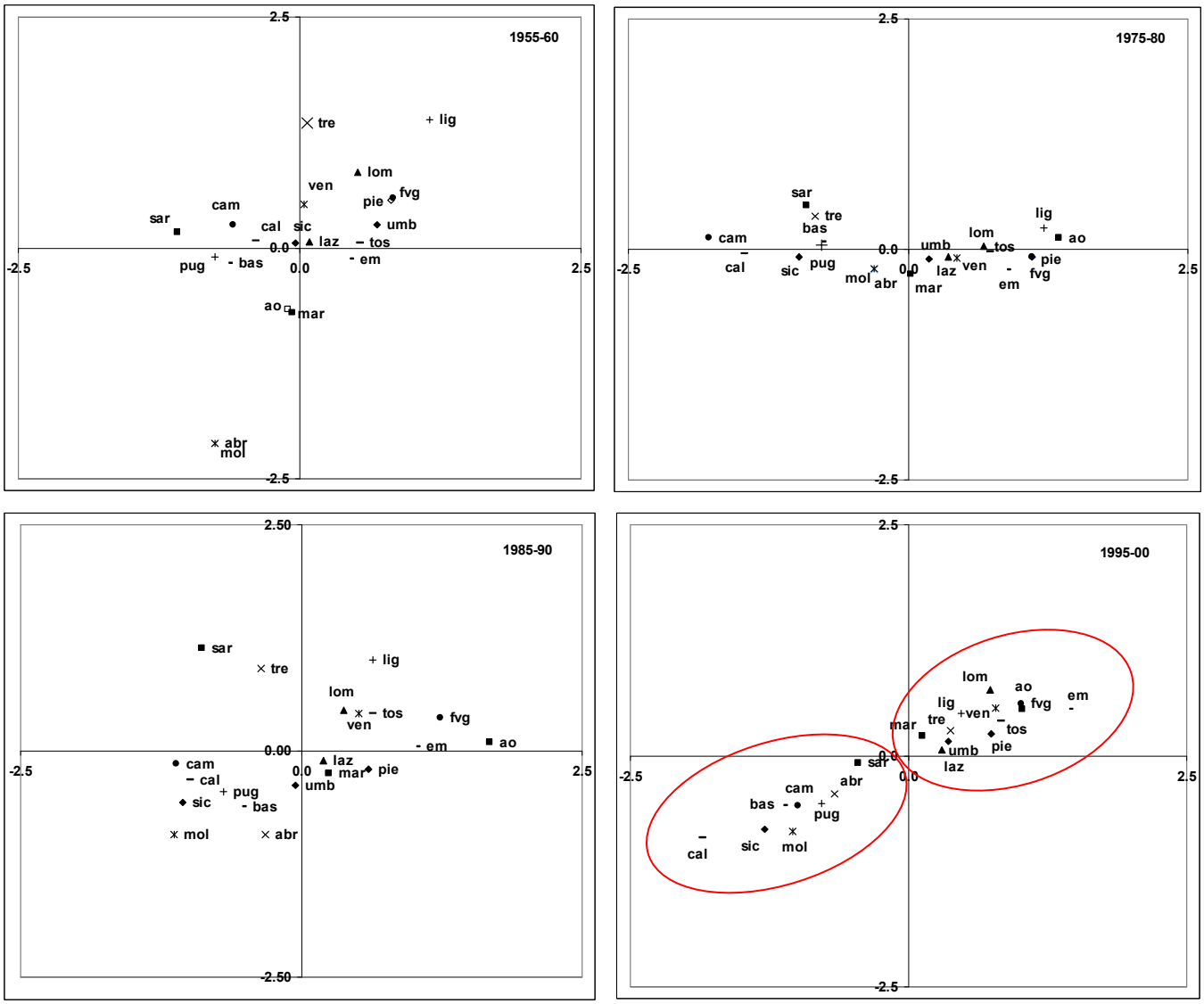


Figure 2 – *Multiway factor analysis. Projection of the Italian regions on the factorial plane. Various years*



4. Conclusions

The long time series by age and birth order specific fertility rates supplied by ISTAT, has helped us to describe broadly the fertility dynamics occurred in Italy and in its divisions and regions paying particular attention to the changes of the reproductive behaviour at older ages. The proportion of the period fertility realized at age 30+ has increased since 1980s, even though showing different regional patterns.

The decomposition model has helped us to capture the effects of quantum and tempo of fertility on the general process of fertility ageing. The model results have highlighted the role of fertility at age 30+ during the last years, showing thus the real changes of the reproductive behaviour in that age group, even if the regional peculiarities still influence the phenomenon trend. The late fertility increase is caused not only by intensity dynamics but recently also by the clear changes of fertility timing. The synthesis through the multiway analysis allowed us to combine the decomposition model results in a uniform regional scenario. This analysis has pointed out the presence of manifest and different territorial changes in terms of late fertility,

almost showing the convergence of the Italian regions towards two different models also as regards the dynamics of fertility timing.

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APPENDIX

The single absolute effects are:

$$\Delta\left(TFR^{I}_{15-29}\right)=\frac{-\Delta TFR^{I}_{15-29}\cdot TFR_{30+}}{TFR\cdot\left(TFR+\Delta TFR^{I}_{15-29}\right)}$$

$$\Delta\left(TFR^{II}_{15-29}\right)=\frac{-\Delta TFR^{II}_{15-29}\cdot TFR_{30+}}{TFR\cdot\left(TFR+\Delta TFR^{II}_{15-29}\right)}$$

$$\Delta\left(TFR^{I}_{30+}\right)=\frac{\Delta TFR^{I}_{30+}\cdot TFR_{15-29}}{TFR\cdot\left(TFR+\Delta TFR^{I}_{30+}\right)}$$

$$\Delta\left(TFR^{II}_{30+}\right)=\frac{\Delta TFR^{II}_{30+}\cdot TFR_{15-29}}{TFR\cdot\left(TFR+\Delta TFR^{II}_{30+}\right)}$$

The double absolute effects are:

$$\Delta\left(TFR^{I}_{15-29},TFR^{II}_{15-29}\right)=\frac{-TFR_{30+}\cdot\left(\Delta TFR^{I}_{15-29}+\Delta TFR^{II}_{15-29}\right)}{TFR\cdot\left(TFR+\Delta TFR^{I}_{15-29}+\Delta TFR^{II}_{15-29}\right)}$$

$$\Delta\left(TFR^{I}_{30+},TFR^{II}_{30+}\right)=\frac{TFR_{15}\cdot\left(\Delta TFR^{I}_{30+}+\Delta TFR^{II}_{30+}\right)}{TFR\cdot\left(TFR+\Delta TFR^{I}_{30+}+\Delta TFR^{II}_{30+}\right)}$$

$$\Delta\left(TFR^{I}_{15-29},TFR^{I}_{30+}\right)=\frac{TFR_{15-29}\cdot\Delta TFR^{I}_{30+}-TFR_{30+}\cdot\Delta TFR^{I}_{15-29}}{TFR\cdot\left(TFR+\Delta TFR^{I}_{15-29}+\Delta TFR^{I}_{30+}\right)}$$

$$\Delta\left(TFR^{I}_{15-29},TFR^{II}_{30+}\right)=\frac{TFR_{15-29}\cdot\Delta TFR^{II}_{30+}-TFR_{30+}\cdot\Delta TFR^{I}_{15-29}}{TFR\cdot\left(TFR+\Delta TFR^{I}_{15-29}+\Delta TFR^{II}_{30+}\right)}$$

$$\Delta\left(TFR^{II}_{15-29},TFR^{I}_{30+}\right)=\frac{TFR_{15-29}\cdot\Delta TFR^{I}_{30+}-TFR_{30+}\cdot\Delta TFR^{II}_{15-29}}{TFR\cdot\left(TFR+\Delta TFR^{II}_{15-29}+\Delta TFR^{I}_{30+}\right)}$$

$$\Delta\left(TFR^{II}_{15-29},TFR^{II}_{30+}\right)=\frac{TFR_{15-29}\cdot\Delta TFR^{II}_{30+}-TFR_{30+}\cdot\Delta TFR^{II}_{15-29}}{TFR\cdot\left(TFR+\Delta TFR^{II}_{15-29}+\Delta TFR^{II}_{30+}\right)}$$

The triple absolute effects are:

$$\Delta\left(TFR^{I}_{15-29},TFR^{II}_{15-29},TFR^{I}_{30+}\right)=\frac{TFR_{15-29}\cdot\Delta TFR^{I}_{30+}-TFR_{30+}\cdot\left(\Delta TFR^{I}_{15-29}+\Delta TFR^{II}_{15-29}\right)}{TFR\cdot\left(TFR+\Delta TFR^{I}_{15-29}+\Delta TFR^{II}_{15-29}+\Delta TFR^{I}_{30+}\right)}$$

$$\Delta\left(TFR^{I}_{15-29}, TFR^{II}_{15-29}, TFR^{II}_{30+}\right) = \frac{TFR_{15-29} \cdot \Delta TFR^{II}_{30+} - TFR_{30+} \cdot \left(\Delta TFR^{I}_{15-29} + \Delta TFR^{II}_{15-29}\right)}{TFR \cdot \left(TFR + \Delta TFR^{I}_{15-29} + \Delta TFR^{II}_{15-29} + \Delta TFR^{II}_{30+}\right)}$$

$$\Delta\left(TFR^{I}_{15-29}, TFR^{I}_{30+}, TFR^{II}_{30+}\right) = \frac{TFR_{15-29} \cdot \left(\Delta TFR^{I}_{30+} + \Delta TFR^{II}_{30+}\right) - TFR_{30+} \cdot \Delta TFR^{I}_{15-29}}{TFR \cdot \left(TFR + \Delta TFR^{I}_{15-29} + \Delta TFR^{I}_{30+} + \Delta TFR^{II}_{30+}\right)}$$

$$\Delta\left(TFR^{II}_{15-29}, TFR^{I}_{30+}, TFR^{II}_{30+}\right) = \frac{TFR_{15-29} \cdot \left(\Delta TFR^{I}_{30+} + \Delta TFR^{II}_{30+}\right) - TFR_{30+} \cdot \Delta TFR^{II}_{15-29}}{TFR \cdot \left(TFR + \Delta TFR^{II}_{15-29} + \Delta TFR^{I}_{30+} + \Delta TFR^{II}_{30+}\right)}$$