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Barbara Zagaglia

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Increasing the mean Age at Childbearing as a Potential Leverage to Contrast Demographic Decline and Population Aging

By Barbara Zagaglia[*]

The aim of this paper is to analyse the potential effects of the increase in the mean age at childbearing in countries with very low fertility rates and a very high level of population aging. Such potential effects have been studied in terms of stable populations. Results for Greece, Italy, and Spain show that a delay in childbearing of one and two years for all women and an increasing mean age at childbearing can contrast both population decline and aging with increasing effects as mean age rises. Thus, increasing the mean age at childbearing is a leverage to be considered by policy makers in low fertility countries with highly critical demographic contexts.

Keywords: *Mean age at childbearing; Childbearing postponement; Population decline; Aging; Policy options*

Introduction

Fertility decline is a globally widespread process. At present, approximately two-thirds of the global population lives in countries with a total fertility rate (TFR) below the approximate replacement rate of 2.1 children per woman (UNFPA 2024)

In general, the process has a positive connotation because it is the result of the modernization of human behaviour. However, some countries experience very low fertility levels, so much so that they eventually find themselves trapped in a particularly unfavourable demographic situation. This is because if fertility persists for a long period of time at very low levels, below the replacement level of generations, a population can find itself with increasingly smaller cohorts of women of reproductive age. Even if these women significantly increase their propensity to have children, they will produce a decreasing number of births over the years, insufficient to compensate for the growing number of deaths caused by the concomitant progress of population aging.

Under such circumstances, policies aimed at mitigating the inevitable population decline and reducing the rapid aging of the population are both highly desirable and urgent, also due to the socio-economic consequences that they entail (reducing labour force, lower productivity, lower economic growth, instability of the public pension and welfare systems, as well as, in general, higher age-related public expenditure).

In countries with persistently very low fertility levels, the State has been unable (or has not deemed it necessary) to implement effective policies to

[*]Associate Professor, Polytechnic University of Marche, Italy.

increase fertility. Such policies − which leverage fertility intensity − must be articulated and well-designed and require a long time, both to be implemented and, above all, to have visible effects.

The aim of this study is to explore alternative policy objectives that are relatively easy to implement and can promptly contrast population decline and aging. One alternative is to leverage the timing of fertility, in particular to increase the mean age at childbearing. Indeed, when generational turnover is insufficient, a later fertility pattern increases the average time interval between generations and a smaller number of children replaces the larger generation of parents more slowly, leading to a slowdown in demographic decline and aging.

In this study, we will analyse the potential effects of changes in the mean age at childbearing in three Southern EU countries: Greece, Italy, and Spain. In these countries, fertility declined to less than 2.1 children for women since the mid-1970s and early 1980s, and since the 1990s fertility is around and below 1.3 children per woman. In these countries, births now steadily exceed deaths and aging is very advanced, in particular Italy, which is at the top of the ageing spectrum in EU. The demographic trap is operating in Italy as documented by Billari and Tomassini (2021), and it could be at work in Greece and Spain as well.

We will study the demographic consequences of the increase in the mean age at childbearing by applying the method of stable populations. The increase will not be calculated and hypothesized a priori but obtained as a result of certain argued shifts in women's reproductive lives. We will therefore measure and evaluate the effect of different postponements, all other demographic parameters being equal. Data used are sourced from the European Statistical Office (Eurostat).

The article is organized as follows. After a literature review, a section deals with the method and data while results are shown in the subsequent section. We finally conclude on the feasibility of the leverage postulated.

Literature Review

In demography, research has extensively analysed changes in the age pattern of fertility over time. In addition to causes, focus has been mainly placed on both the relation with, and their consequences for, fertility intensity (for a comprehensive discussion of the matter, see Beets 2011, Skirbekk 2022).

In contrast, age patterns and mean age at childbearing have rarely been studied for their implications on the future size and age structure of populations. Beets (2011) addressed the issue stating that a population characterised by an early pattern of childbearing will have higher population growth than a population with a late pattern. He also asserted that postponement, which increases the intergenerational distance between parents and children, if it results in a lower lifetime number of children, will lower population growth and will reinforce population ageing. However, Beets refers to populations with positive growth rates, not distinguishing between increasing or decreasing populations.

In less developed countries, in particular Sub-Saharan Africa, childbearing occurs early, fertility rates are high, and population growth is substantial. The implications of postponing childbearing were analysed by the United Nations Department of Economic and Social Affairs (2019). The results showed that later fertility schedules can be effective in achieving a slower pace of population growth and more favourable age structures, both of which are essential to promoting economic development and accelerating progress towards the achievement of the Sustainable Development Goals.

In contrast, in more developed countries childbearing occurs late, fertility rates are low, and population growth is very low or even negative. A study by Moretti and Zagaglia (2006) investigated the influence of the timing of fertility on the growth potential of the Italian population. The results showed demographic scenarios sensitive to fertility schedules and the possibility of obtaining less critical situations, both in terms of growth and aging.

In more developed countries, debate on policies has focused on the need and way to increase the number of children per woman (Poston and Bouvier 2010, Sobotka et al. 2019, Wilkins 2019). Also, the possibility to fuel immigration has been considered (Poston and Bouvier 2010, UNFPA 2023, European Commission 2025).

Some scholars have suggested that policies explicitly target the timing of births (Billari et al. 2006). The aim in this case is to counterbalance, or even reverse, the postponement of childbearing but the final goal is still to increase total fertility.

Our study builds on the seminal work of Moretti and Zagaglia (2006) and aims to provide an effective and readily implementable alternative to policy leverages considered so far.

Data and Method

Stable Population Model

To analyse the effects of increases in the mean age at childbearing on population size and age structure, we applied the stable population model. This model is a well-established and fundamental tool in demographic analysis (see, for instance, Preston et al. 2001). In particular, it allows to evaluate the impact of variations in fertility and/or mortality parameters net of the influence of the current population structure since the population growth rate ("intrinsic growth rate" or "Lotka's rate") and the population distribution by sex and age of a stable population are determined exclusively by age-specific fertility rates and age-specific mortality rates, when a closed population is considered.

We applied a discrete female-dominant model, without migration. We proceeded, first, with the estimate of the intrinsic growth rate of the population, second, with the calculation of the stable female population distributed in one-year age intervals and, finally, with the stable male population similarly distributed in one-year age intervals, considering a 1.06 newborn males to 1 newborn female constant rate.

In estimating the intrinsic growth rate, ρ, we considered the following relation:

$$[1]\rho = \frac{ln(R_0)}{T}$$

where *T* is the generational time interval and R_0 is the Net Reproduction Rate. In a closed population, it corresponds to the rate of natural increase.

We estimated *T* by the mean age at childbearing corrected by female mortality (MACm);

$$[2] \qquad MACm = \frac{\sum_x x f_x \frac{L_x^F}{l_0}}{\sum_x f_x \frac{L_x^F}{l_0}}$$

While

$$[3]\ R_0 = 0.485 \sum_x f_x \frac{L_x^F}{l_0}$$

f_x denotes the age-specific fertility rate, while L_x^F and l_0 are the number of years lived at age x for females and the size of a birth cohort in a life table, respectively.

The resulting approximated value of ρ was then corrected in a reiteration process to satisfy Lotka's equation

$$[4] \qquad 1 = \sum_x e^{-\rho x} f_x \frac{L_x}{l_0}$$

For the procedure applied, see Livi Bacci (1990).

It should be noted that there exists an inverse relation between the generational time interval and the rate of population growth: an increase in T reduces ρ in absolute value. The sign and the extent depend on the value assumed by the net reproduction rate and will be greater the more it, negative, is less than unity. It should also be noted that the effect of a change in the fertility schedule has both a direct effect on ρ, via T, and an indirect effect, via R_0.

The number of years lived at each age (L_x), drawn from the female and male life tables, and the fertility rates by mother's age (f_x) are sourced from the Eurostat online database (https://ec.europa.eu/eurostat/data/database).

Hypotheses

We analysed the effects of current mortality and fertility conditions ("equivalent stable population") and compared them with the effects produced by alternative fertility age schedules: the age specific fertility rate recorded in 2023 postponed by one year of age (Hypothesis 1); the age specific fertility rate recorded in 2023 postponed by two years of age (Hypothesis 2). For Greece and Italy, we also considered a further hypothesis (Hypothesis 3) of a relative distribution of fertility rates as currently observed in Spain, where women have a later fertility schedule because of a lower propensity to have children in their mid-20s to mid-30s. The assumptions on mortality as well as the fertility intensity are the same as observed in 2023. [1]

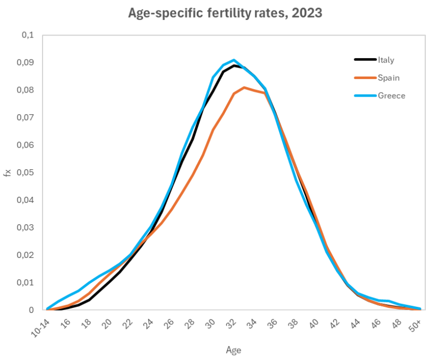
Summary fertility and mortality measures observed in 2023 in the three countries are shown in Table 1 while the age-specific fertility rates of 2023 are shown in Figure 1; the different assumptions are summed up in Table 2.

Table 1. *Summary fertility and mortality measures for Greece, Italy, and Spain – Year 2023*

	TFR	*MAC*	*e_0 females*	*e_0 males*
Greece	1.26	32.08	84.4	79.2
Italy	1.21	32.51	85.4	81.4
Spain	1.12	32.59	86.7	81.3

Source: Eurostat data

Figure 1. *Age-specific fertility rates of Greek, Italian, and Spanish women – Year 2023*



Source: Own elaboration on Eurostat data

[1] Latest available complete data are for year 2023.

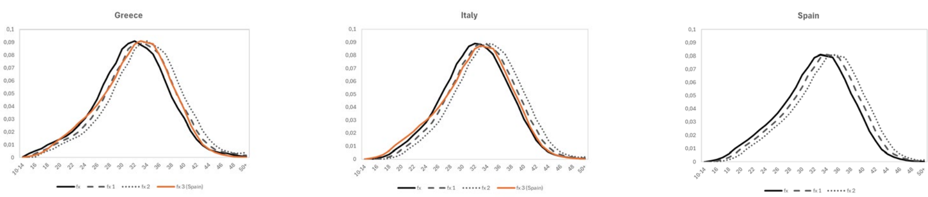
Table 2. *Assumptions on Fertility and Mortality*

	Assumptions		
	Fertility		*Mortality*
	Fertility Intensity	*Fertility schedule*	*Mortality schedule*
Stable equivalent	As 2023	As 2023	As 2023
Hypothesis 1	As 2023	As 2023 +1 year	As 2023
Hypothesis 2	As 2023	As 2023 +2 years	As 2023
Hypothesis 3*	As 2023	ASFR/TFR as 2023 in Spain	As 2023

Note: * For Greece and Italy only

For a better comprehension of the different assumptions on the fertility schedule, the fertility distributions by age for each country are represented graphically and shown in Figure 2.

Figure 2. *Age-specific Fertility Rates under the Various Hypotheses*



Source: Own elaboration on Eurostat data

Results

Population Decline

In Italy − the country with the longest-standing fertility rate below replacement − if current fertility and mortality conditions were constant, with a MACm of 32.57 years and an R_0 of just over 0.58, a growth rate of -16.44 per thousand would be obtained. (Table 3)

The sole temporal change in fertility of all women postponing childbirth by one year (Hypothesis 1), with a corresponding increase in MACm of 1.22 years, would reduce the intrinsic growth rate by 0.92 thousandth points, while a further delay of one year (Hypothesis 2) and an increase of 1.3 years in MACm would lower it to -14.42 per thousand, also because of a significant rise in R_0. On the contrary, a fertility behaviour at various ages of Italian women equivalent to that of Spanish women (Hypothesis 3) would not have significant effects. (Table 3)

Spain, although it has a less critical demographic past than Italy, currently has a much lower total fertility and a higher female life expectancy at birth, which strongly affects the intrinsic growth rate. Under these invariant conditions, the growth rate would be -18.68 per thousand. A postponement as in Hypothesis 1 would lead to an increase in MACm similar to Italy, but a smaller effect on the R_0, still improving the growth rate similarly. A postponement as in Hypothesis 2 would have a lesser effect than in Italy but it would be far from negligible since the intrinsic growth rate would increase to -16.73 per thousand. (Table 3)

Greece has a higher total fertility than Italy and Spain at 1.26 children per woman and a less critical net reproduction rate, despite higher mortality. This situation is the best of the three countries, with a growth rate of the corresponding stable population of less than -15 per thousand. A one-year delay in the birth of a child (Hypothesis 1), with a corresponding increase in MACm from 32.12 to 33.70 years, would not only increase the intrinsic growth rate, but the effect would be greater (+1.1 thousandths of a point) than in Italy and Spain, because of a greater effect on both MACm and R_0. (Table 3)

A two-year delay (Hypothesis 2), corresponding to a 3.19-year increase in MACm, would produce an even greater effect on the intrinsic rate of increase (+2.75 thousandths of a point). The assumption of an age distribution of fertility equivalent to that of Spanish women (Hypothesis 3), despite causing an increase in MACm of about half a year, would be detrimental. This is because the effect it would produce on R_0 would be negative and prevail over the opposite effect induced by the increase in MACm. (Table 3)

Table 3. *Mean Age at Childbearing, Net Reproduction Rate, and Intrinsic Growth Rate in Different Stable Populations − Greece, Italy, and Spain*

	Greece			*Italy*			*Spain*		
	MACm (years)	*R_0*	***ρ* *(‰)***	*MACm (years)*	*R_0*	***ρ* *(‰)***	*MACm (years)*	*R_0*	***ρ* *(‰)***
Stable equivalent	32.12	0.616	**-14.92**	32.57	0.583	**-16.44**	32.60	0.541	**-18.68**
Hypothesis 1	33.70	0.625	**-13.82**	33.78	0.589	**-15.53**	33.81	0.545	**-17.77**
Hypothesis 2	35.31	0.648	**-12.17**	35.10	0.600	**-14.42**	35.06	0.553	**-16.73**
Hypothesis 3	32.60	0.607	**-15.20**	32.60	0.583	**-16.43**	−	−	−
	Variation (comparison with stable equivalent population)								
	(Years)		**(‰)**	(Years)		**(‰)**	(Years)		**(‰)**
Hypothesis 1	1.58	0.009	**1.10**	1.22	0.006	**0.92**	1.21	0.005	**0.91**
Hypothesis 2	3.19	0.032	**2.75**	2.53	0.017	**2.02**	2.46	0.012	**1.95**
Hypothesis 3	0.49	-0.010	**-0.28**	0.04	-0.000	**0.02**	−	−	−

Note: (−) not concerned; ρ, error < 0.0002
Source: Our elaboration on Eurostat data

Ageing

Postponing childbearing could have a positive effect not only on the population growth rate and size, as shown above, but also on population age structure.

Compared to the current situation, whatever the assumptions we considered and all demographic behaviours being constant, there would be a decrease in the share of the population at young and adult ages and an increase in the share of the elderly and very elderly population, finally resulting in a rise both in the elderly-to-young ratio (Elderly ratio or Aging index) and in the elderly-to-adult ratio (Elderly support ratio). However, a progressive postponement would have a mitigating effect, which would be greater the longer the postponement. It should be noted, however, that the advantage would be greater in terms of pure aging than in terms of elderly support. (Tables 4-6)

In Italy, postponing childbearing by two years, even with a total of 1.21 children per woman, would reduce the share of people aged 65 and over by almost two percentage points (from 38.26% to 36.30%) and the share of people aged 85 and over by approximately 0.70 percentage points (from 9.33% to 8.63%). The elderly ratio would also decrease from 416 to 360 and elderly support ratio from 73 to 68. (Table 4)

In Greece, constant behaviours would produce a less intense aging than in Italy, whatever the conditions considered. The two-year postponement (Hypothesis 2) would have a greater effect, both in absolute and in relative terms, than in Italy on the elderly ratio and the elderly support ratio, which would decrease from 346 to 285 and from 64 to 58, respectively. The share of people aged 65 and over would decrease by 2.56 percentage points and that of people aged 85 and over by 0.83 (from 35.19 to 32.63 and from 7.81 to 6.98 respectively). (Table 5)

On the contrary to Greece, in Spain constant behaviours would cause an even more intense aging than in Italy, regardless of the conditions considered. Even more important for our purposes, the effect of the postponement on ageing would be greater than in Italy in both Hypothesis 1 and Hypothesis 2. In particular, the best effect would be on the elderly-to-young ratio under the assumptions of Hypothesis 2; the indicator would decline from 507 to 441. (Table 6)

Finally, as for population growth, it should be noted that a distribution of age-specific fertility rates corresponding to that currently observed for Spanish women would produce different effects in Italy than in Greece. In Italy, the effect would be irrelevant, due to a very slight improvement in the indicators, while in Greece the consequence would be undesirable, owing to worsening indicators.

Table 4. *Various Age Structure Indicators in different Stable Populations – Italy (values per hundred)*

	$P_{0\text{-}14}$	$P_{15\text{-}64}$	P_{65+}	P_{85+}	**Elderly ratio**	**Elderly support ratio**
Current values	12.4	63.60	24.00	7.6*	194	38
Stable equivalent pop.	9.21	52.54	38.26	9.33	416	73
Hypothesis 1	9.60	53.04	37.37	9.01	389	70
Hypothesis 2	10.09	53.61	36.30	8.63	360	68
Hypothesis 3	9.21	52.55	38.24	9.33	415	73
	Variation (comparison with stable equivalent population)					
Hypothesis 1	0.39	0.50	-0.89	-0.33	-26.24 (-6.31)	-2.36 (-0.032)
Hypothesis 2	0.88	1.08	-1.96	-0.71	-55.65 (-13.38)	-5.11 (-7.0)

Hypothesis 3	0.01	0.01	-0.02	-0.01	-0.46 (-0.11)	-0.04 (-0.05)

Note: Absolute variations, relative variations in brackets; Elderly ratio $=P_{65+}/P_{0-14}$; Elderly support ratio $= P_{65+}/P_{15-64}$; $^*P_{80+}$
Source: Our elaboration on Eurostat data

Table 5. *Various Age Structure Indicators in different Stable Populations – Greece (values per hundred)*

	P_{0-14}	**P_{15-64}**	**P_{65+}**	**P_{85+}**	**Elderly ratio**	**Elderly support ratio**
Current values	13.3	63.70	23.00	7.1*	173	36
Stable equivalent pop.	10.16	54.65	35.19	7.81	346	64
Hypothesis 1	10.67	55.18	34.16	7.47	320	62
Hypothesis 2	11.45	55.93	32.63	6.98	285	58
Hypothesis 3	10.04	54.51	35.45	7.90	353	65
	Variation (comparison with stable equivalent population)					
Hypothesis 1	0.50	0.53	-1.03	-0.34	-25.91 (-7.49)	-2.49 (-3.89)
Hypothesis 2	1.28	1.28	-2.56	-0.83	-61.13 (-17.67)	-6.05 (-9.45)
Hypothesis 3	-0.12	-0.14	0.26	0.09	6.93 (2.0)	0.65 (1.01)

Note: Absolute variations, relative variations in brackets; Elderly ratio=P65+/P0-14; Elderly support ratio= P65+/P15-64; $^*P_{80+}$
Source: Our elaboration on Eurostat data

Table 6. *Various Age Structure Indicators in different Stable Populations – Spain (values per hundred)*

	P_{0-14}	**P_{15-64}**	**P_{65+}**	**P_{85+}**	**Elderly ratio**	**Elderly support ratio**
Current values	13.60	66.20	20.20	6.0*	149	31
Stable equivalent pop.	8.16	50.43	41.41	11.51	507	82
Hypothesis 1	8.52	50.98	40.50	11.13	475	79
Hypothesis 2	8.95	51.60	39.46	10.70	441	76
	Variation (comparison with stable equivalent population)					
Hypothesis 1	0.36	0.55	-0.91	-0.39	-32.20 (-6.35)	-2.67 (-3.26)
Hypothesis 2	0.79	1.16	-1.95	-0.82	-66.45 (-13.11)	-5.63 (-6.86)

Note: Absolute variations, relative variations in brackets; Elderly ratio=P65+/P0-14; Elderly support ratio= P65+/P15-64; $^*P_{80+}$
Source: Our elaboration on Eurostat data

Conclusion

Results clearly showed that fertility postponement and increasing mean age at childbearing can counteract both population decline and aging in highly critical demographic contexts. In particular, results showed that a postponement of childbearing of all women of one and, even better, of two years in Greece, Italy and Spain can soften population fall, aging and elderly support. Furthermore, a two-year postponement would be very effective in contrasting the population shrinkage of Greece and in reducing the growing old of Spain. Different ways of postponing childbearing should instead be carefully considered and analysed. For example, an increase in the mean age at childbearing due to the adoption of reproductive behaviours at various ages equivalent to those of Spanish women today would not, in fact, be effective for Italy and Greece.

Increasing the mean age at childbearing is an additional leverage to be considered by policymakers that can be immediately and easily implemented. Yet, it should not be considered a substitute for long-term policies aimed at increasing the intensity of fertility.

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