# Can immigration solve the ageing problem in Italy? A few reasons to believe that it cannot*

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**Abstract**

Immigration from the developing countries is beneficial for a rich, ageing country. However, unless under extreme assumptions (of very strong and temporary immigration of *gastarbeiter*), its effects are modest and relatively short lived: after a while, immigrants too become older and retire; their fertility typically adapts rather quickly to the standards of the host country; and, in all cases, the share of foreigners increases very rapidly if immigration is meant as a substitute for low fertility and missing births. These intuitive considerations, here supported by the results of a set of simulations specifically tailored on the case of Italy, lead to the conclusions that immigration cannot counter ageing, only alleviate a little bit its extremes: structural adjustments, and a fertility closer to replacement levels, have no substitute.

## 1. Introduction

"Problems have solutions, predicaments have not ...". On the basis of this initial aphorism and of the long discussion that ensues, MacKellar (2000: 389) comes to the following conclusion:

> *Whatever steps policymakers take, young people are going to have to pay higher taxes (out of higher incomes), old people are going to have to work longer, and retirees are going to have to get by on pensions lower than they were promised and on sales of assets likely worth less than they had hoped. There is no solution, which is why ageing is a predicament, not a problem.*

Those who agree with MacKellar might as well spare themselves the trouble of reading the rest of this paper: they should already be convinced that not even immigration can do anything against ageing, which is the thesis that I am about to defend here. But my reasons differ from MacKellar's, and, indeed, I do not share his view: ageing and all the related consequences (standards of living, pension benefits and burden, etc.) are matters of degrees, not of black or white, and it may make a lot of difference to have one's pension reduced by 5 of 50%, or, on the temporal scale, to see changes materialize abruptly or very gradually over the decades.

The true question is, I believe, a quantitative one: by how much can we hope that immigration will attenuate the ageing problem (without creating new problems, I would add)? Will this contribution be substantial? The traditional way of tackling this issue is to prepare scenarios, with and without migration, and compare them: see, e.g. Feld (2000), Fotakis (2000), United Nations (2001), European Commission (2006, 2009), Gil-Alonso (2009), and others. This paper is no

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exception, but, in this case, special attention will be devoted to a few, in my opinion important but normally ignored, details. They are listed in the following section.

## 2. Indicators, values, and caveats

### *2.1 How do we measure ageing?*

Ageing is a multidimensional phenomenon that, by definition, can be measured in several different ways. In this paper I will use the following indicator

1) $$c = \frac{oO + yY}{A + oO + yY}$$

where $c$ is the equilibrium "contribution rate" that the adults $A$ must pay to maintain themselves, the old $O$ and the young $Y$, each group at the socially "accepted", relative standard of living (De Santis 2006). This cost $c$ may be in part implicit, if we also count the goods and services that do not go through the market: e.g. the care of children and elderly provided by the adult members of a family. The standard of living, conventionally set at $a$=1 for the adults, is $o$ for the old and $y$ for the young. If we assume, for instance, that $o$=$y$=1, i.e. if we believe that children and elderly are as costly as the average adult, then $c$ transforms into

2) $$ID = \frac{O + Y}{P}$$

($P$=$Y$+$A$+$O$= population), which is an index of demographic dependency.

The advantage of my indicator $c$ over $ID$ is double. Firstly, it appears as an implicit tax levied on the adults to maintain those who, for reasons of age, do not work (yet, or any more)[1]. Secondly, my approach is, in principle, more transparent and flexible: the relative weights $o$ and $y$ must be explicitly chosen, and this not only gives us a degree of freedom that is lacking in $ID$, but it also makes it clear that policy choices interact with what happens in the real world. For instance, let us think of $o$ as mainly caused by pension benefits: if these are low, the proportion $O/P$ may increase without impacting too much on our contribution rate $c$.

In practice, however, the advantage of $c$ over $ID$ gets partly lost: to the best of my knowledge, there are no reliable indicators of the actual (relative) costs of the old or the young, and even when they can be estimated - e.g. by looking at age specific consumption profiles, as in Mason (2005) or other papers of the NTA-National Transfer Accounts project (http://www.ntaccounts.org/web/nta/show), these costs are very likely contingent on circumstances. For instance, societies might be more generous with the old when there are but a few of them, and tighter when they are too many, otherwise their total cost would become unbearable. Or vice versa: a large share of elderly may seize political power and obtain more favourable treatment at the expenses of the other segments of the society, a fear first voiced by Preston, back in 1984, and periodically re-surfacing in the debate: see e.g. Demeny (2010).

[1] In the simplest case, all the adults are employed ($A$=$E$), and their average earning is, say, $W$=100 (gross, i.e. before the contribution rate). Imagine that the shares of young and old in the population are, respectively, $Y$=20% and $O$=30%, and imagine further that relative costs are $y$=20% and $o$=60%. With these values, eq, (1) leads to $c$=30.6%, and $N$ (=net wage) becomes N=$W$(1-$c$)=69.4. The average pension benefit will then be $P$=$No$=69.4·0.6=41.7 and child benefits (i.e. the relative average costs of each child) will be $C$=$Ny$=69.4·0.2=13.9. Note, however, that the simplifying assumption that $E$=$A$ is not essential here. If the employment rate $E/A$ is lower than 1 (e.g. 67%), and if the average worker still earns $W$($E$)=100 (gross), the average adult earns $W$($A$)=67 (=67% of 100, gross). All calculations can now be repeated, and all monetary values are 33% lower than before, leaving relative positions unaffected. Let me insist on this important point: a higher average wage $W$, or employment rate $E/A$, or both, are preferable, of course, because they enhance the standard of living of the society. But they are (or, at least, can be and, in this paper, will be assumed to be) neutral from the point of view of the (relative) demographic burden.

*2.2 The relative costs of the young and the old*

The standard values that I have arbitrarily chosen for the relative costs of the young and the old are, respectively, $y$=20% and $o$=60%. Alternative, but relatively close, specifications do not alter the basic characteristics of the picture that we will see shortly (not shown here). Indeed, these alternatives impact on the *level* of the equilibrium contribution rate, but not so much on its *evolution*, which is what most interests us here.

Instead, a different story would emerge if $y$ and $c$ were made to depend on the relative weight of the young and the old in the population, and thereby to evolve over time. This approach is appealing, but, lacking clear indications as to how to model this dependency, I did not try it in this paper.

*2.3 Who is young and who is old?*

Among the policy choices that shape the process of population ageing, the one about threshold ages is particularly important. Let us first note that one can create as many population groups as he/she likes (and adjust equation 1 accordingly), but simulations[2] suggest that the main results that emerge from the use of three groups only (young, adult, and old) are not basically altered if age classes increase. With three classes we only need two threshold ages: $\alpha$ (separating the young from the adults) and $\beta$ (separating the adults from the old). For the sake of brevity I will also occasionally call $\beta$ "retirement age", in the following.

As with the relative costs of the age groups ($y$ and $o$, discussed in the previous sections), alternative specifications of $\alpha$ and $\beta$ impact on the level of $c$ but they hardly affect its evolution (not shown here). Instead, dynamically different results emerge if $\alpha$ and $\beta$ vary with survival conditions ($e_0$, life expectancy at birth, for brevity).[3]

To the best of my knowledge, this dynamic adjustment has thus far been proposed only for the retirement age $\beta$ (not for $\alpha$), according to either of the following criteria (Caselli and Egidi 1992):

a) $e_0$-$\beta$ = constant (i.e. $\beta$ increases with $e_0$, on a one-to-one basis);

b) $e_\beta$ (life expectancy at age $\beta$) = constant.

The alternative that I am considering here (see De Santis 2006 for more details) refers instead to both $\alpha$ and $\beta$, and is such that

c) $Y^*$ ($=T_y/T_0$), $A^*$ ($=T_a/T_0$) and $O^*$ ($T_o/T_0$) are all constant

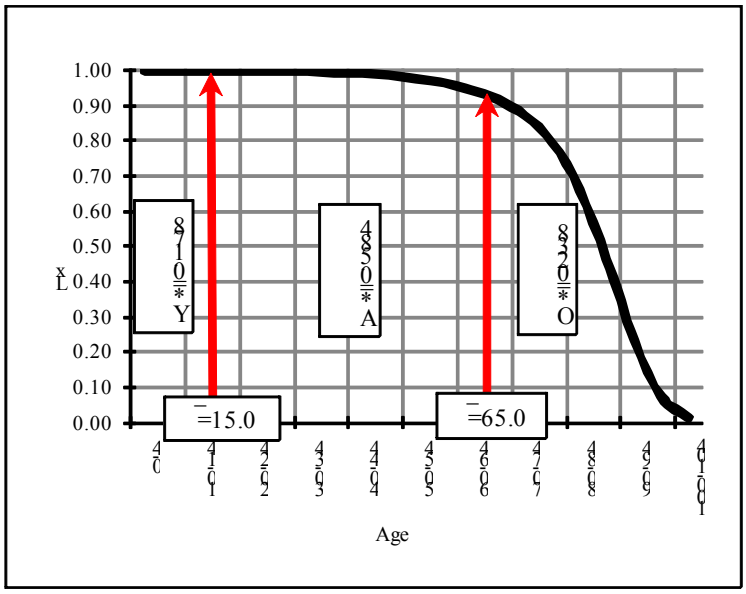
where $T_y$ , $T_a$ and $T_o$ are, respectively, the total number of years lived in one's youth, adulthood and old age ($T_y+T_a+T_o=T_0$), and where $Y^*$, $A^*$, and $O^*$ are the corresponding proportions over the whole life course ($Y^*+A^*+O^*=1$).

In order to see more clearly what this means, let us consider a survival curve: Figure 2.1 shows that the total number of life years $T_0$ (the area below the survival curve) can be divided into three sub areas $T_y$, $T_a$ and $T_o$ ($T_y+T_a+T_o=T_0$), by any two vertical lines, drawn at the ages $\alpha$ and $\beta$. For instance, in Italy, where $e_0$ is currently 84 (for women), drawing the lines at $\alpha$=15 and $\beta$=65 implies that $Y^*$ ($=T_y/T_0$)=17.8%, $A^*$ ($=T_a/T_0$)=58.4% and $O^*$ ($=T_o/T_0$)=23.8%. These proportions, with an asterisk, can be interpreted as the share of life that an average woman would spend in her youth, adulthood and old age, if mortality conditions were not to change over time.

[2] Not shown here, but see, e.g. De Santis (2006).

[3] Indeed, different survival curves, of the type represented in figure 1, may lead to the same number of years lived $T_0$, and therefore also to the same average length of life $e_0$. However, when $e_0$ is high by historical standards, as in Italy and in all other rich countries, these differences are minor, and I will ignore them in this paper.

Fig. 2.1 - Survival curve with $e_0$=84.0 (Italy, 2007, women), and with α=15 and β=65




Source: Istat

In the real world, however, mortality conditions do change, and without adjustments in the threshold ages, the proportions $Y^*$, $A^*$ and $O^*$ would change, too. But it is possible to move α and β in such a way that $Y^*$, $A^*$ and $O^*$ remain constant at the initially chosen values (that is, in this example, at 17.8%, 58.4% and 23.8%, respectively). For instance, should female life expectancy pass from 84.0 to 90.7 (as in the scenarios that we will consider shortly), without adjustments, our proportions would become, $Y^*$=16.5%, $A^*$=54.8% and $O^*$=28.7%. This can be avoided, by gradually shifting α from 15.0 to 16.2 and β from 65.0 to 69.5 (as in Figure 2.2).

It can be proven, but I will not do it here, that, without migration, $Y^*$, $A^*$ and $O^*$ are the averages of, respectively, $Y_t$, $A_t$ and $O_t$, that is of the actual proportions of young, adults and old in the society, over the calendar years $t$, and this is why, in the following, I will refer to these proportion, and more generally, to the age distribution of this peculiar population (Figures 2.1 and 2.2), as "reference" or "standard" age structure.[4]

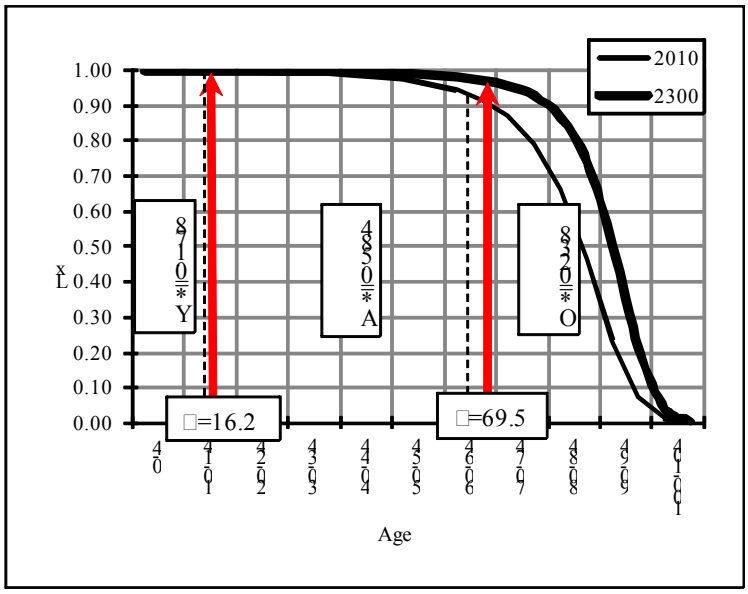
It follows that, adjusting eq. (1), we can also obtain

3) $$c^* = \frac{oO^* + yY^*}{A^* + oO^* + yY^*}$$

where $c^*$ is the long term average of $c_t$, that is of our measure of ageing.

[4] Which, incidentally, is also the age structure of the stationary population associated with the current life table.

Fig. 2.2 - Survival curve with $e_0$=90.7.0 (Italy, future, women), and with α=16.2 and β=69.5



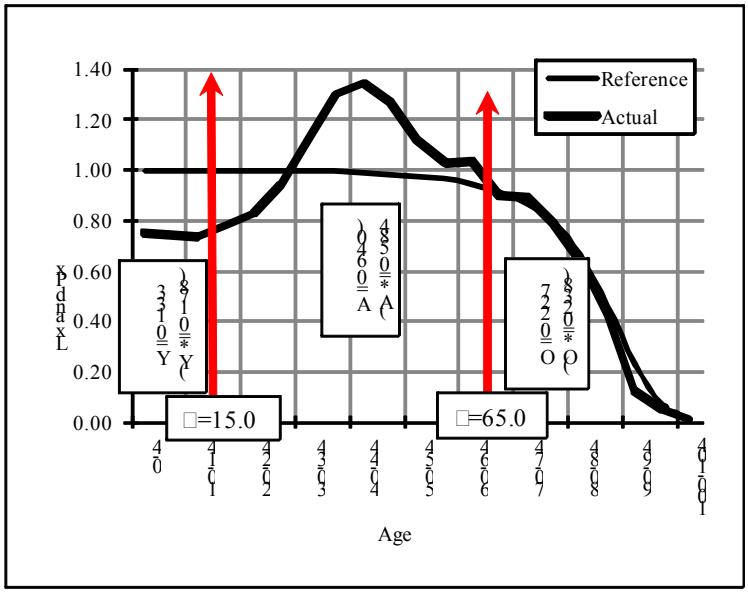

Source: Author's elaborations

Notice that, with this approach, ageing "from above" is by definition excluded, in the long run: longer survival does not alter the ultimate proportions of young, adults and old in the society, if thresholds age adjust so as to keep longer life spans into account. What remains are temporary, albeit long and possibly important, deviations from the average, which produce distortions in the age structure, for instance of the kind shown in Figure 2.3, for the year 2010. The responsibility for these distortions rests primarily with fertility, and the peaks and troughs in the series of births that it causes, but mortality variations and migration flows also play a role.

With temporary migration, nothing changes: asterisks still denote the asymptotic value of the corresponding variables (see. e.g. the simulation of Figure 2.4 for the next 300 years). It is only with permanent migration that we observe a discrepancy between the two (e.g. $c^*$ and the asymptotic value of $c_t$), although these differences become large only in highly implausible circumstances, that is with a large and permanent migration flow.[5] These assertions about the effect of migration on the differences between $c^*$ and $c_{asymptotic}$ are not proven here, but illustrative examples can be found in the simulations of the next sections.

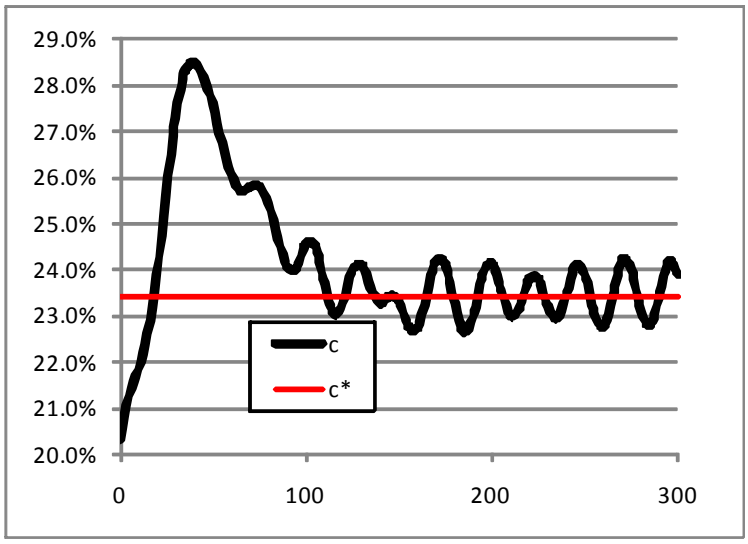
[5] And also when the population disappears (see section 3.1) or explodes (not shown here).

Fig. 2.3 - Reference and actual age structure of the Italian women, in 2010




Source: Istat

Fig. 2.4 - Reference ($c$*) and actual ($c$) contribution rate in a simulation




Source: Authors's elaboration (cf. Figure 3.2)

*2.4 A definition and a measure of the demographic bonus*

The introduction of $c$*, and the comparison with $c_t$ at any point in time $t$ (as in Figure 2.4), permit us to better appreciate the distortion in the age structure, and measure the frequently mentioned, but (to my knowledge) never properly defined, notion of "demographic bonus". In broad terms, a demographic bonus (or dividend, or "window of opportunity") can be defined, with Wikipedia, as "that period of time in a nation's demographic evolution when the proportion of population of working age group is particularly prominent". I suggest that the demographic bonus be simply measured by the difference

4) $$\Delta = c^* - c_t$$

If, in year $t$, $c_t$ is below its long term average ($c_t$<c*) there is a bonus, and, conversely, if it is above it, there is a demographic malus: the larger the gap between the two ($c_t$ and its average $c$*),

the larger the bonus (or malus). For instance, in Italy in 2010,[6] the starting point of our scenarios, given our assumptions ($\alpha$=15; $\beta$=65; $y$=0.2; $o$=0.6), $c_{2010}$=20.3%, while $c^*$=23.4: there is currently a non negligible demographic bonus ($\Delta$=3.1%), which, by definition, will sooner or later turn into a demographic malus, because, the long term average of $c_t$ is $c^*$=23.4, and therefore the long term average of $\Delta$ is zero. Notice that, by adopting eq. (4), a demographic bonus is not defined "in itself": it also depends on the policy choices that have been taken on the threshold ages (here $\alpha$ and $\beta$, but there could be more), and on the relative standards of living of the various age groups (here only $y$ and $o$, with $a$=1).

### *2.5 Time*

My demographic scenarios start on 1 Jan. 2010, and go on for 300 years, at 5-year intervals. The time scale may appear unreasonably long as compared to our interests and our knowledge of the future, but, while those who only care about the next, say, 20 or 30 years will find here the information they are looking for, I would also like to take this opportunity to substantiate (although not prove) my claims on the long term properties of my "astersiked" variables, and also those on the likely long-term effects of migration.

The long term perspective also helps us get rid of the specificities of the starting population: the structural traits of the future populations that I will consider in my scenarios depend in part on the initial characteristics (Italian women, in 2010), and in part on the assumed course of fertility, survival and migration. As time goes by, the influence of the starting population progressively diminishes and eventually disappears: after a century, at most, all the structural features of the population depend only on what has happened in the past 100 years, and not on how things were at the beginning (ergodicity property).

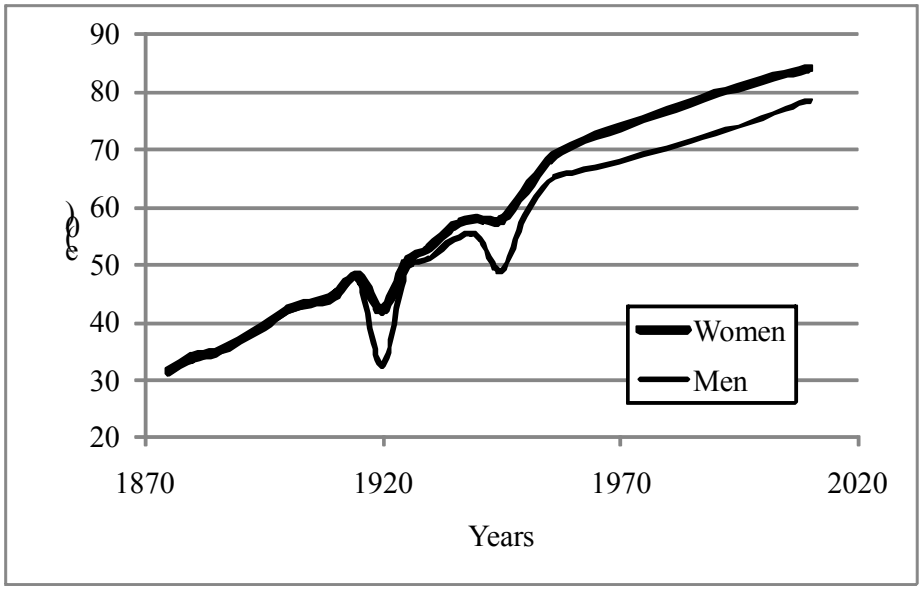
### *2.6 Mortality*

As mentioned before, my simulations refer to women, for the structural part (especially fertility and mortality). Currently, women in Italy live about 84 years on average, and the average length of life has been increasing steadily in the past 150 years (apart from occasional very minor fluctuations, and two large drops in war periods - see Figure 2.5), as in almost every other rich country. All indications are that it will continue to increase, although probably at a reduced pace (Vallin and Meslé 2010). My assumption here is that the increase will be approximately linear,[7] from now on, but slow: about a week per year, instead of the 2-3 months observed in recent times. Eventually, 300 years from now, life expectancy will reach $e_0$=90.7, and the survival curve will be that of Figure 2.2.

[6] This refer to women, but basically the same conclusion holds also for men (not shown here). Actually, there is a small time discrepancy in the comparison of Figure 3: actual population figure refer to 2010, while the life table is that of 2007. In the discussion, I am assuming that the life table of 2010, when it becomes available, will not differ substantially from that of 2007.

[7] All survival curves have been obtained with a logit (Brass-type) transformation. I assumed linear variations in the logits, which is not exactly linear in the actual values.

Fig. 2.5- Evolution of life expectancy at birth in Italy: 1872 to 2007




Source: Human Mortality Database (www.mortality.org)

Alternative, but reasonable, scenarios of mortality (not shown here) do not affect my conclusions very much. What matters more is my assumption that mortality will be the same for the native and the immigrant population, and also for the intermediate category of "population with foreign origin" (see section 2.9). But this assumption seems to me to be a tenable one: the few indications that we have suggest that immigrants are more (not less) healthy than the residents, even if they come from poor countries and even if their economic status is low. Their advantage depends on a strong selection factor (only the strongest can afford a migration) and perhaps also on a more prudent attitude on their part: knowing that they must rely on themselves, because their families are far away and the host society is not very friendly, they do not indulge in dangerous habits (e.g. drinking, driving fast, practicing extreme sports, etc.; see, e.g., Molina and Costa 2007). In the long run, both factors should wither, and the disadvantages of lower status might then emerge for those who have immigrated long before, and for their descendants, although this may be partly obscured by the arrival of new waves of selected immigrants.

*2.7 Fertility*

In my scenarios, there are three population subgroups (Italians, foreigners and population of foreign origin, see section 2.9) but only two fertility schedules. Their shape is assumed to be the same, but levels differ. Foreing women have recently had a total fertility rate (*TFR*) of about 2.4 children per woman (Gesano, Ongaro, Rosina, 2007), and this value is assumed to remain constant in the future.

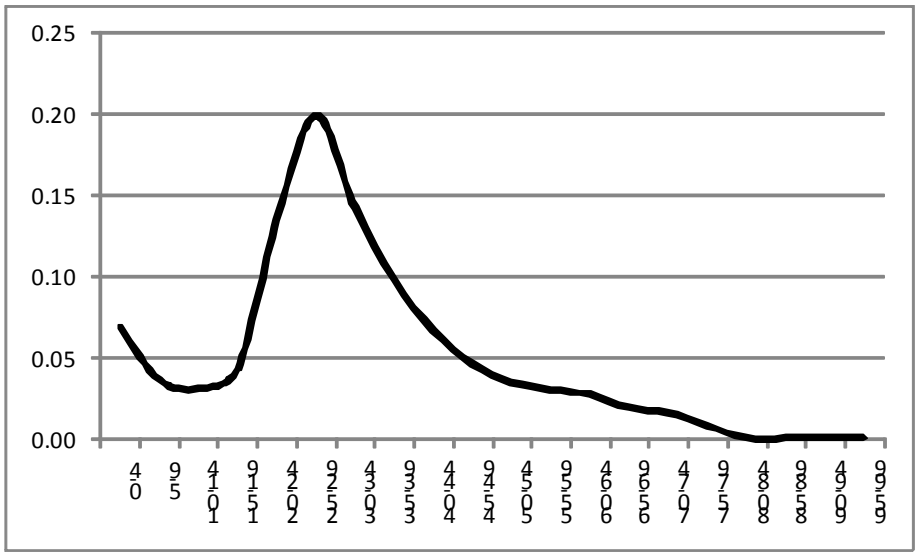
Italians and women of foreign origin are assumed to have lower levels (the same between the two groups): the starting point is TFR=1.4 (close to the current value), and the evolution varies in the different scenarios. Notice that my starting point (*TFR*=1.4) is the one that currently refers to Italy as a whole, and higher than the estimates that refer exclusively to the Italians within Italy (*TFR*≈1.3; see Salvini and De Rose, 2011). But these extremely low levels are in part due to a postponement effect that biases period measures downward, and some signs of catch-up are emerging in recent data. Therefore I deemed it more realistic to adopt a slightly higher (even if still very low) level as the minimum for fertility.

*2.8 Immigration*

Italy is a country of prevalent immigration, and I have decided to ignore her all in all non negligible out-migration rate. This assumption bears more implications that it may appear at first sight because I am implicitly contending that those who immigrate are here to stay, and will not get back to their mother country (or anyway go somewhere else) in their old age.[8]

The age profile of immigration is assumed to remain the one recently observed in Italy (Figure 2.6), which is a very classic one, with a great concentration of immigrants in the working ages.

Fig. 2.6 - Assumed distribution of foreign immigrants, by age




Source: Own elaborations on Istat data

*2.9 Foreigner: for how long?*

An immigration is basically the same as a birth in the population, except for two important details. One: the newcomer is not aged 0, but $x$, if immigration takes place at age $x$ (e.g. 20 years). In most cases, this is an advantage: our equation (1), for instance, says that children have costs (e.g. of education and care), while adults have not. An immigrant arriving past age $\alpha$ (here: 15 years) saves the receiving country the costs of rearing and education.[9] The second detail is that the immigrant may not be easily or immediately accepted by the resident population. One way of evaluating how big potential problems of integration may be is to look at the share of foreigners in the population: past a certain threshold, some say, tensions arise, e.g. in the form of slums, ghettos, social unrest, criminality, etc. Although nobody, to the best of my knowledge, could ever indicate a precise value, this imaginary threshold is generally believed to lie somewhere between 10 and 20%.

But there is a very important, if underestimated, question to solve when tackling this issue: for how long will an immigrant remain a foreigner? The simplest, and (in models) most frequent answer is: "forever", but this is probably not the best one. Not legally, for sure: several immigrants can and do indeed change their nationality after a while, or acquire a new one. In Italy, the quickest way has traditionally been through marriage with an Italian[10], although a prolonged stay (of 10

[8] Even if they did, however, not all the costs of old age would be spared. For instance, those who have reached the required minimum number of years of contribution to the pension system mature a right to a pension benefit, independently of where they live.

[9] This probably underestimates the costs of integrating immigrants, even if they arrive at relatively high ages: for instance assisting them in their first years of stay in acquiring the necessary skills (e.g. language, job training, etc.).

[10] Before the law of 2009 (L. 94/2009), it took 6 months of marriage, to become an Italian; now, it takes 2 years, reduced to one if there are children.

years, or more) also gives the right to apply for the Italian citizenship, and an increasing number of long term immigrants now fulfill this requirements, and even more will, in the future. In year 2008, almost 60 thousand foreigners became Italians, and the trend is upwards (Salvini and De Rose 2011).

But the question appears to me to be relevant also from the cultural perspective: independently of one's passport, one may feel, and be perceived, as part of a community: if he/she is well integrated, speaks the language, works with Italians, plays with them, etc. When this happens, the latent hostility that derives from "not knowing your neighbor" dissolves, little by little, at least in most cases (DeWaard 2011).

In short, there is a question of "transformation" of a foreigner into a national: how long does it take, how can we model it, and what does a foreigner transform into? In this paper, I introduce a parameter that regulates the "persistence into the status of foreigner" after each period (5 years). Unfortunately, lacking reliable empirical estimates to guide me in establishing a reasonable value for this parameter, I have arbitrarily set it at 0.8.[11] In short, I am assuming that out of 100 foreigners who are present today (and who will not die in the next five years), 80 will still be foreigners 5 years later: 64 ($100 \cdot 0.8 \cdot 0.8 = 100 \cdot 0.8^2$) will still be foreigners 10 years later; and so on. The young are an exception, however: they cannot marry, and they can only apply for the Italian citizenship after they become of age. Therefore, I allow them to start becoming Italians (80% of them) only in the passage from 15-19 to 20-24 years.

I apply the same parameter (80%) also to the births of foreign women in Italy. The nationality of the newborn depends in this case on the nationality of the father: for instance, in Italy, in 2008, 21% of the almost 92 thousand births from a foreign mother had an Italian father (and the newborn was therefore an Italian), while the remaining 79% had a foreign father (and the newborn was register as a foreigner).

The 20% of the foreigners that lose their status become, in my model, "Italians of foreign origin": an intermediate category, with which I intend to capture the effect of what in Canada is sometimes referred to as a "visible minority". A foreign accent, somatic traits, extremely curly hair, and the like are visible signs of a non-Italian origin that it may be interesting to try to keep track of, in our models. But, of course, it is not only a matter of appearances: a foreign origin may translate into a peculiar styles or habits in food, religion, socialization ... This is something that, depending on one's orientation, may be interpreted as a cultural stimulus, or a menace to "the sacred tradition of our fathers", or, more neutrally, as a measure of how a society evolves over time. In my modeling, I will assume that the characteristics of being "of foreign origin" is preserved for life, but the children of this group are fully Italians, both legally and culturally.

Notice that changing one's status has some implication on population dynamics: mortality is the same for all three subgroups, but fertility is higher for the foreigners (TFR=2.4) and lower for the others (initially TFR=1.4, later on somewhat higher). Becoming Italian (of foreign origin) contributes to lowering the fertility in Italy.

At the start of my scenarios (2010), I have no sure information about the population "of foreign origin", and also too unreliable information on the number of irregular immigrants. Therefore, I form only two groups: Italians and (regularly resident) foreigners. I am clearly underestimating the foreign presence in Italy; hopefully, this bias should not be too large and, certainly, it matters less and less as time goes by, for the same ergodicity property mentioned before.

[11] Readers should be cautioned that alternative values for this parameter can make a considerable difference, with regard to how large the share of foreigners tends to become over time, given a certain immigration flow. Simulations are not shown here, but the double curve of the next figure (Foreigners and Italians of foreign origin) may give an idea of how many foreigners there would be if the conditions of being a foreigner were a permanent one.

## 3. The benchmark and the other scenarios

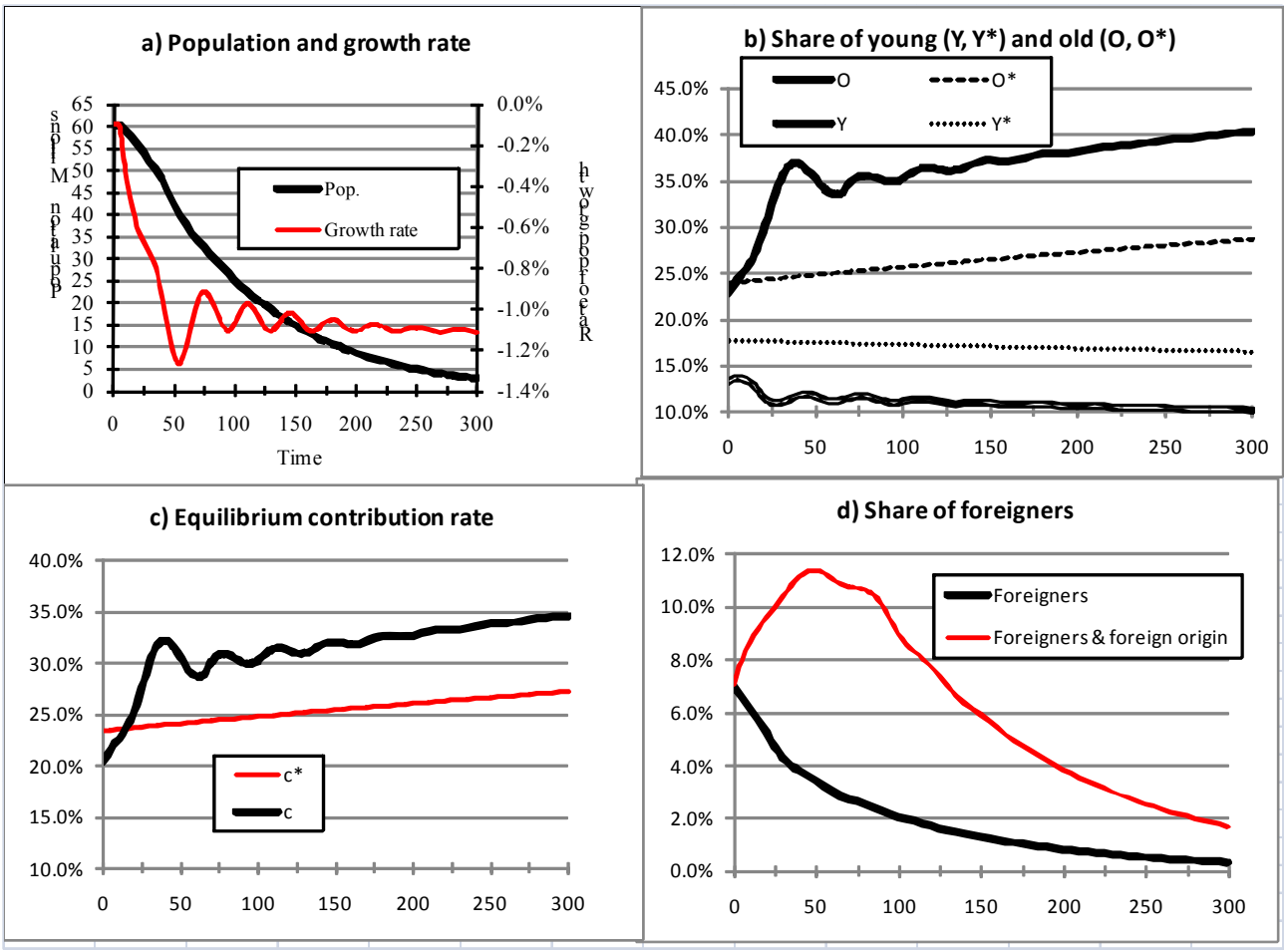
This long introduction helps us understand that population projections, especially if they include migration and changes of status (foreign, of foreign origin, Italian) are a complex mechanism, where several variables interplay. In this context, it is not so easy to fully understand the role of a single variable. This is normally done by keeping all the others constant, but: at what level and for how long? The idea of extrapolating current trends is simple and may sound appealing, but it is surely not a good one: most trends simply cannot be preserved forever, and sooner (in the case of Italy) or later (everywhere else), they lead to impossible outcomes. Italy, for instance, would soon be canceled in the constant-fertility, no-migration scenario of section 3.1.

I will therefore take the opposite stance: use as a benchmark the "Utopian, no-migration" scenario of section 3.2, which can be considered the best that could very theoretically happen in Italy, ruling out immigration. But this outcome is highly unlikely: progressively more likely are a few alternative possibilities, considered in sections 3.3 to 3.7.

### *3.1 Scenario: Constant fertility, no migration*

Imagine that the following assumptions hold for Italy, for the next 300 years:
*i*) no immigration,
*ii*) *TFR*=1.4 for the Italians and *TFR*=2.4 for the foreigners (both constant),
*iii*) $e_0$ slowly increasing, from 84.0 to 90.7 (same for all subgroups), but
*iv*) threshold ages ($\alpha$ and $\beta$) are not adjusted to the longer duration of life,
*v*) 20% of the foreigners become "Italians of foreign origin" after 5 years, in each period.
What would happen of the population in Italy? The answer is in Figure 3.1.

Fig. 3.1 - Demographic consequences of the scenario: "Constant fertility, No migration"




*=Reference values (see text for explanation). Source: Author's elaborations.

The rate of increase would soon become and remain strongly negative (-1.1%), and the Italian population would practically disappear (part a). Fewer and fewer youngsters (down to 10%), coupled with more and more elderly (up to 40% - part b) would lead to a high an ever increasing cost of ageing (part c). In this apocalyptic scenario, the only good news is that the share of the foreign population, which would be declining rapidly, could not possibly constitute a problem, not even for the most xenophobic observer (part d). Notice, however, that even in this case (with no migration) the share of the population with at least foreign origin (which means: foreigners plus Italians of foreign origin) would initially increase, for the next 50 years or so, up to about 11%. The reason is that the foreigners who are already in Italy are numerous (7%) and, by assumption, more fertile than the Italians ($TFR_f$=2.4, $TFR_i$=1.4): their descendants, of foreign origin, are therefore going to be relatively more numerous in the next generation.

I don't believe that this scenario will ever materialize, and I don't think that anybody can believe it. Therefore, I do not consider this to be a convenient benchmark for our exercise. But there are two reasons why I have introduced it here. On the one hand, it serves us as a warning against the risks and biases of simple extrapolations of current trends. On the other, it helps us to become familiar with the figures and the key variables that we will use in the next sections.

To this end, please note that in these figures there are not only the actual, but also the "reference" values for *Y** and *O** (share of young and old in the population; part *b*), and for *c** (implicit contribution rate, or cost of ageing; part *c*). Only, these reference values seem to be of scarce use, here: they are not constant, and actual values do not converge on them. Why?

Reference values are not constant because, in this scenario, as $e_0$ increases, the threshold ages α and β are not adjusted: the rising in O* and c* gives us a measures of the long-term cost of ageing

that derives from living longer (also called "ageing from above"), if no counterbalancing measures are taken. And actual values do not converge on the reference ones because of the (to me, implausible) assumption that the population can keep on decreasing forever.[12] As soon as we drop this idea, and adopt more realistic views (that the size of the Italian population can change, even substantially, but with floors and ceilings) the reference values resume their basic function: they inform us about where actual values, with all of their variability and oscillations, are heading.

*3.2 Scenario "Utopian, No Migration" (TFR→2.06 and dynamic threshold ages)*

If the assumption of constant fertility (*TFR*=1.4) is scarcely defendable, what else can we adopt as a benchmark for the zero-migration option? The alternative that I suggest is: "the best possible scenario that could theoretically occur". This does not mean that I believe that it will (I don't, actually): but, at least, the possibility of its occurrence is not totally excluded.

This scenario shares several common traits with the preceding one (no immigration; life expectancy increases slowly from 84.0 to 90.7, and 20% of the foreigners become "Italians of foreign origin" after 5 years, in each period). But there are two important differences:

*ii*) fertility. The *TFR* of the Italians is assumed to increase slowly but steadily from 1.40 (first quinquennial period) to 1.45 (second period) to 1.50 (third), etc. up to 2.06. After that, it tends to remain constant, but with oscillations (which I have introduced in this and the next scenario, so as to show that they are irrelevant, in the long run);

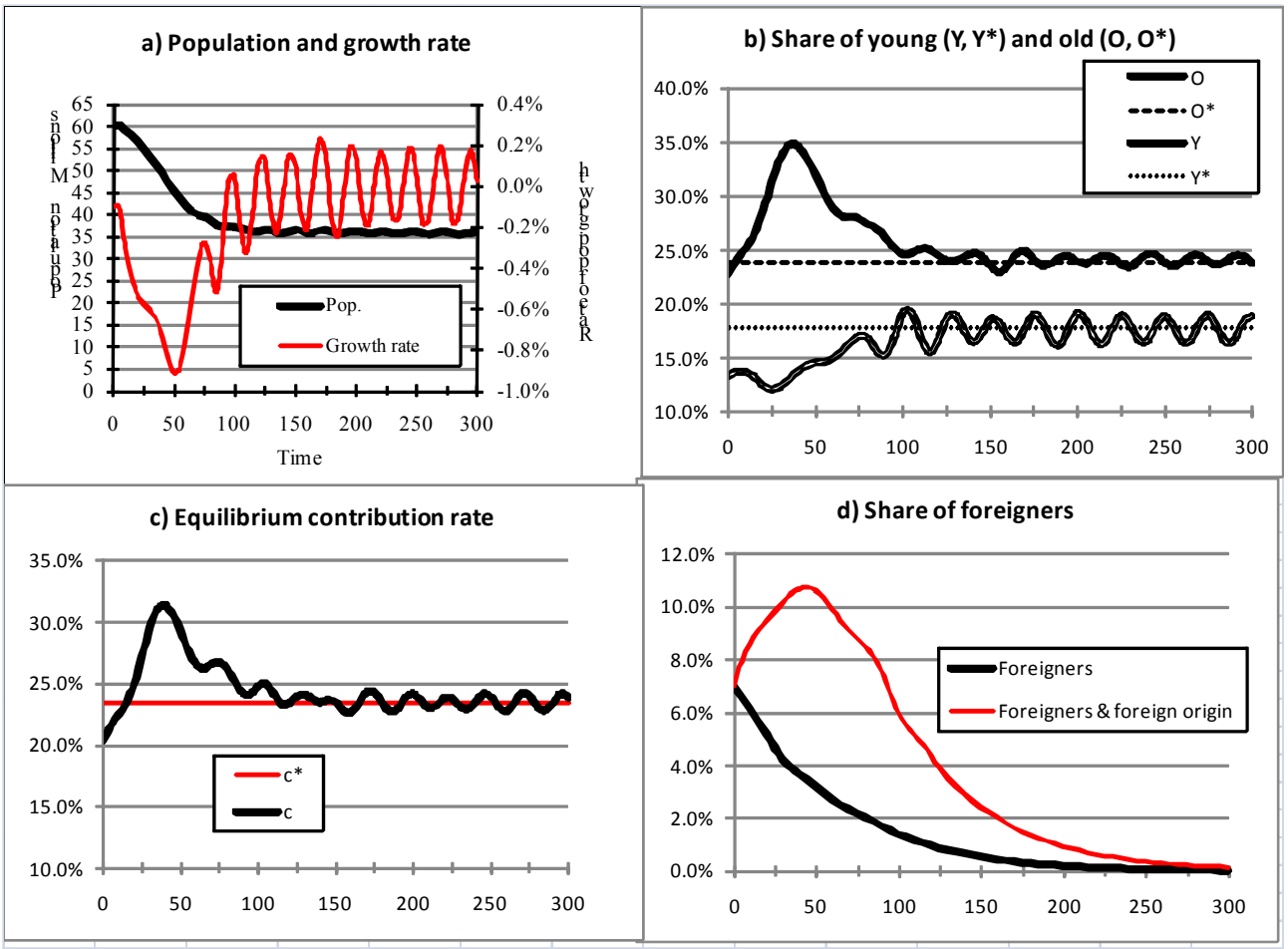
*iv*) threshold ages ($\alpha$ and $\beta$) adjust to the longer duration of life. In practice, as $e_0$ increases from 84.0 a 90.7 (in 300 years), $\alpha$ passes from 15.0 to 16.2, and $\beta$ from 65 to 69.5 (see again Figure 2.2).

Of course, this scenario is not something that can materialize "naturally". It would require an enormous social and political effort: closing the frontiers, on the one hand; and then setting up family-friendy policies, so as to stimulate fertility; and, finally, progressively deferring the retirement age (and also $\alpha$), etc. Notice, finally, that I am not advocating this scenario: I am simply contending that it is the very best that we could imagine, if we decided to close our frontiers to immigration (*and* were capable of enforcing this decision).

The results are presented in Figure 3.2. The most important things to notice are:

[12] The same non-convergence, but with inverted signs, emerges in the opposite, equally unrealistic scenario, of an ever increasing population (not shown here).

Fig. 3.2 - Demographic consequences of the scenario "Utopian, No Migration"




*=Reference values (see text for explanation). Source: Author's elaborations.

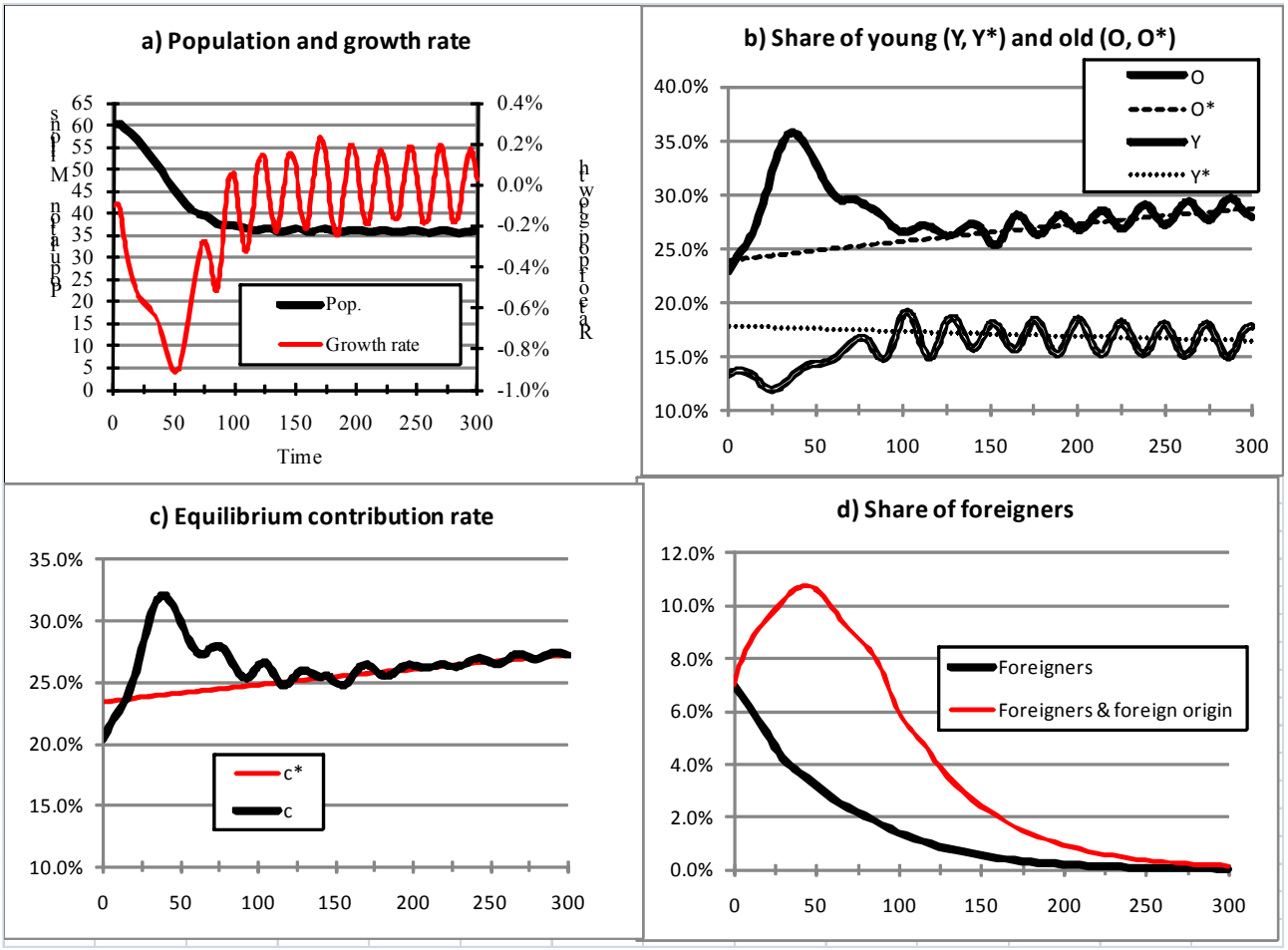
- in parts (*b*) and (*c*), reference values (*Y**, *O** and *c**) remain constant for the whole period. Notice, incidentally, that their level is entirely dependent on collective preferences about α (which determines *Y**), β (which determines *O**), and *y* and *o* (the relative costs of the young and the old, which, together with *Y** and *O**, determine *c** - see eq. 3);
- in parts (*b*) and (*c*), actual values eventually converge on the corresponding reference ones, which, as anticipated, act as "attractors". In other words, we know where we are heading;
- in part (*a*), the population living in Italy declines substantially, from 60 to 36 million inhabitants. This decline takes place in the next 100 years or so: after then (by construction), the population remains constant;
- in part (*b*), the rapid and strong ageing process that will characterize the next 40 years. The costs of this are going to be very high, and the equilibrium contribution rate will skyrocket, from $c \approx 20$ (currently) to $c \approx 31\%$ (in 40 years), before getting back to its "normal" level of $c^* \approx 23\%$:
- foreigners, by definition, are not a problem in this scenario, but, as before, the presence of people with at least a foreign origin will follow a hump: their share will increase in the next 50 years or so, up to about 11%, and then decline and eventually disappear.

### *3.3 Scenario TFT=2.06*

This scenario is the same as te preceding one, except that, in this case, we do not adapt threshold ages to increases in $e_0$. Therefore, we get in part the same results (same population, part *a*, and same share of foreigners, part *d*), but we get more ageing "from above": more people are (conventionally

considered) old (part *b*), and this impacts negatively on the long-term costs of ageing (part *c*). The short term hump in the implicit cost of ageing (part c) remains, and becomes slightly worse.

Fig. 3.3 - Demographic consequences of the scenario *TFR*=2.06




*=Reference values (see text for explanation). Source: Author's elaborations.

### *3.4 Scenario TFR=1.85 (and compensating immigration)*

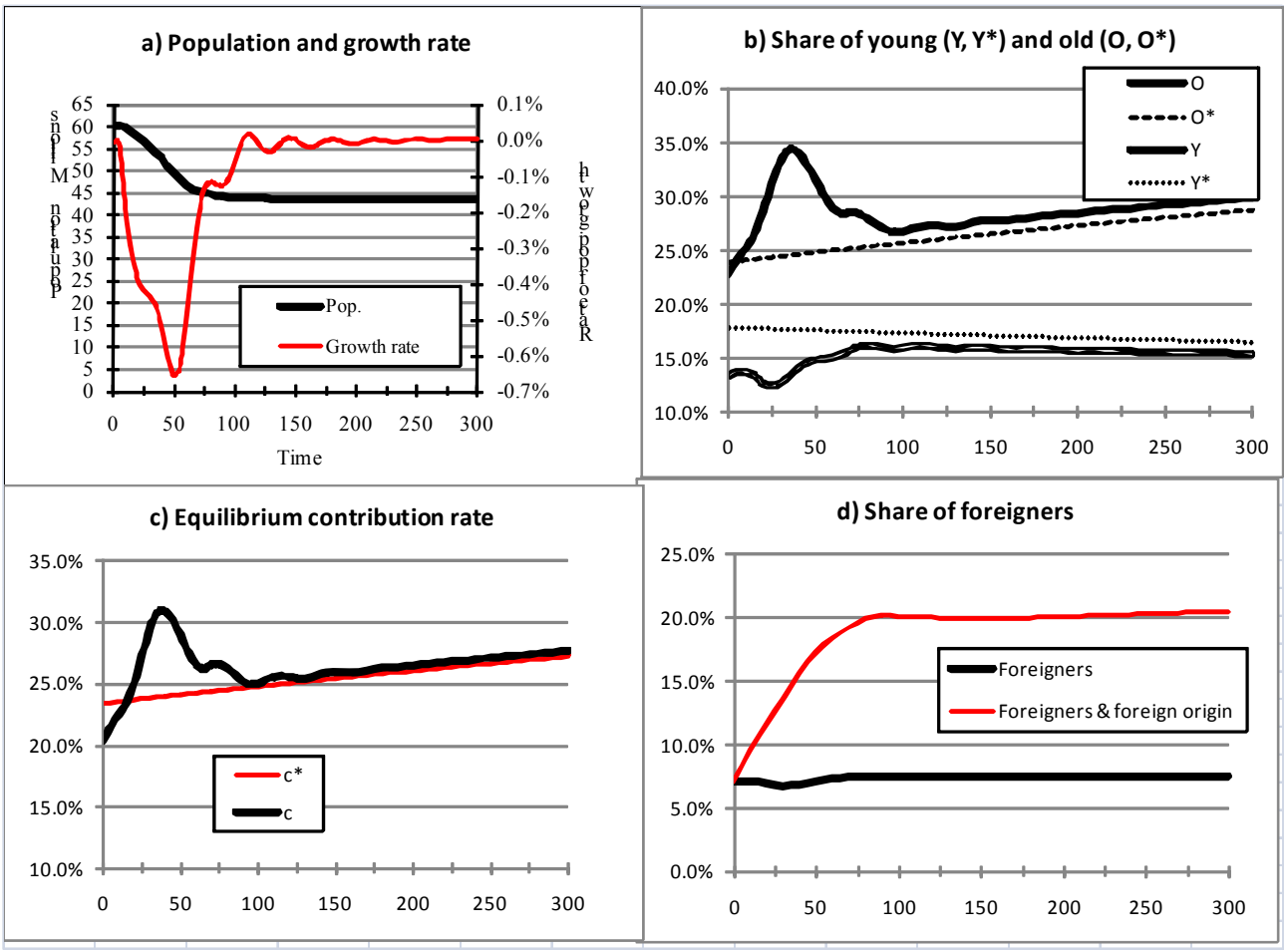
Same as before, except that fertility here increases only up to *TFR*=1.85. However, The population living in Italy eventually stabilizes, thanks to an influx of immigrants, that, by assumption, is constant, in absolute terms, in every period.[13] With a few calculations, this amounts to about 145 thousand female immigrants per quinquenniun (about 60 thousand immigrants of both sexes per year - and we have had up to 300 thousand per year, in recent years).

This case (figure 3.4) does not differ very profoundly from the previous one. The share of the young is systematically below its reference value ($Y<Y^*$) and that of the old is systematically above it ($O>O^*$): with *constant* immigration, as anticipated, the population converges towards an age structure that differs slightly from the standard (based exclusively on a given survival schedule). But the differences are minor, especially in terms of the implicit costs of ageing (part c). Notice, incidentally, that immigration does not lower these costs in the long run: the reason is that immigrants are adults when they arrive, but eventually become old, exactly as the rest of the population. They are beneficial in the first years, but basically neutral in the long run.

[13] Of course, there is no particular reason to assume that the number of immigrants should remain constant for 300 years - except that it becomes perhaps easier to understand what it is being hypothesized. For an alternative assumption (strong immigration initially, progressively less in the future) see section 3.7.

Notice finally, that even with this relatively minor influx of immigrants, the share of foreigners stabilizes at the non trivial level of 7% (basically, the same that we have today), but the share of population with at least foreign origin grows steadily for the next 100 years and then stabilizes at little more than 20%.

Fig. 3.4 - Demographic consequences of the scenario *TFR*=1.85



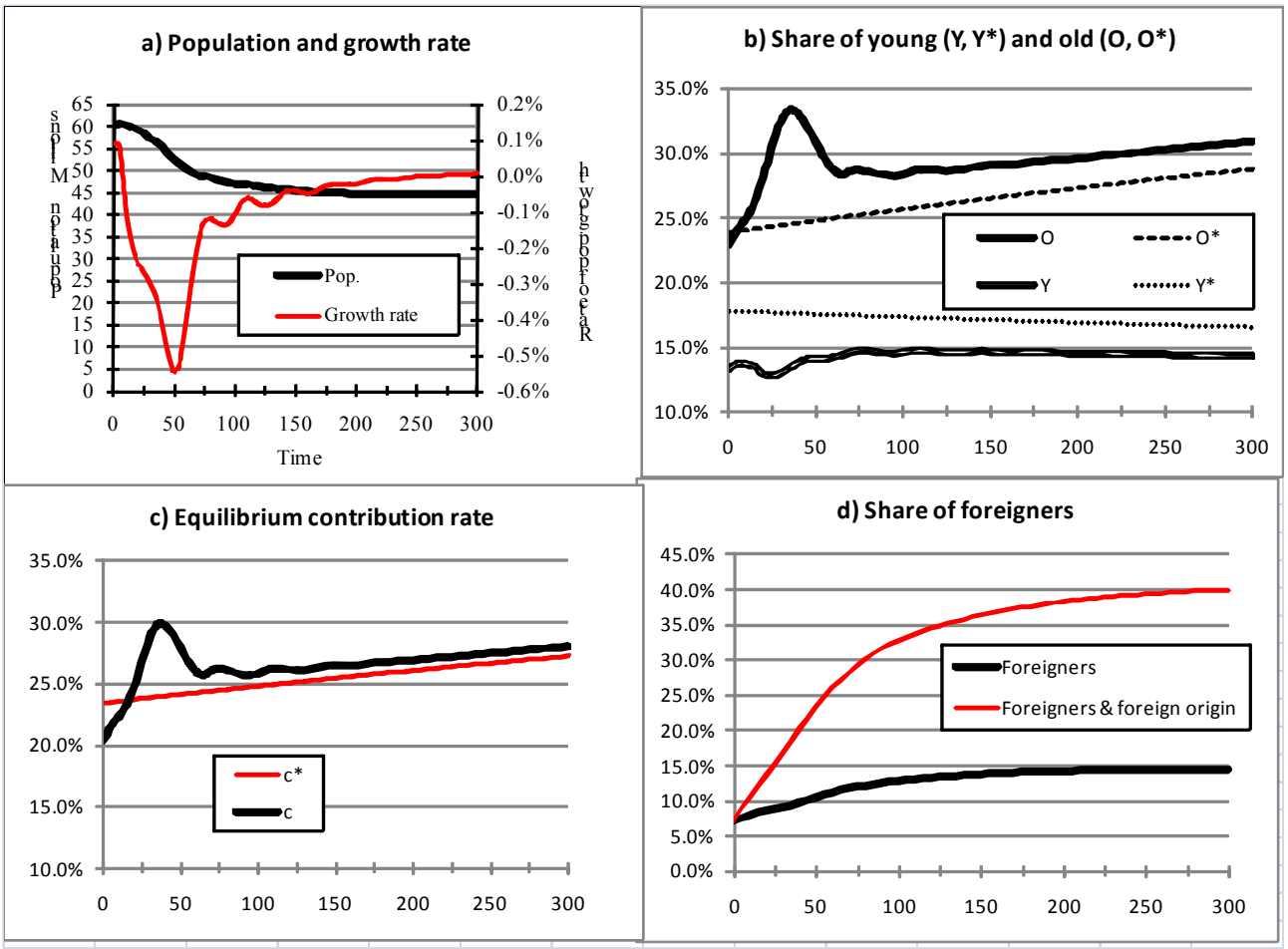

*=Reference values (see text for explanation). Source: Author's elaborations.

### *3.5 Scenario TFR=1.60 (and compensating immigration)*

This scenario is basically the same as the previous one, but the recovery of fertility stops earlier, when *TFR*=1.6, and remains constant afterwards. Immigration is (assumed to be) constant in each period, and such that, eventually, the rate of increase becomes null. We need about 290 thousand female immigrants per quinquenniun (about 115 thousand per year) to that end, twice as much as in the previous case.

The consequences (Figure 3.5) are in line with the preceding scenario, only slightly worse in terms of ageing (part *b*) and related costs (part *c*). And the share of immigrants rises to 15%, while they and their descendents together eventually account for up to 40% of the population. This is a huge modification indeed, as compared to the situation of today, and not a particularly slow one either, since most of the change takes place within the next 50 years.

Fig. 3.5 - Demographic consequences of the scenario *TFR*=1.60

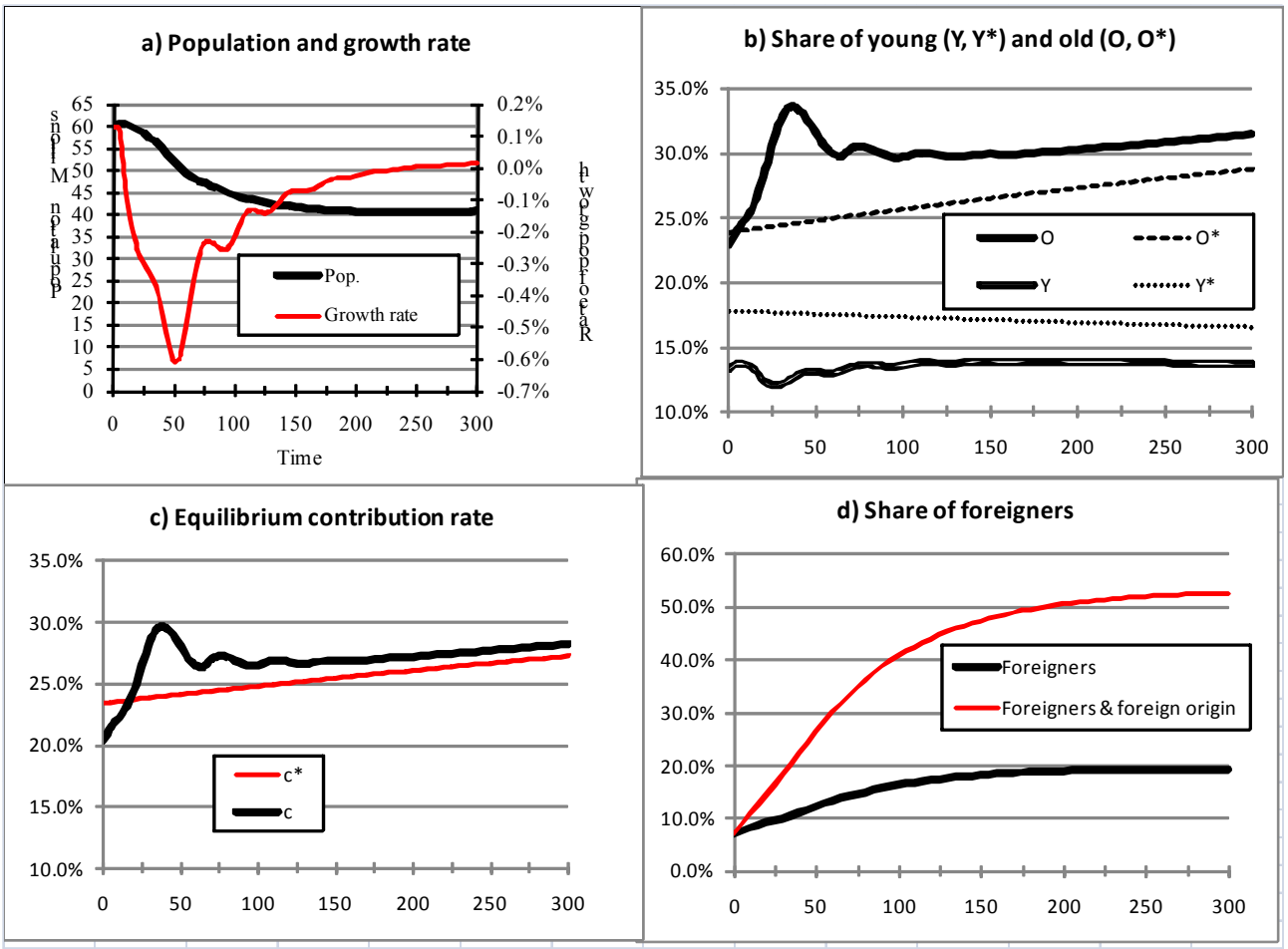



*=Reference values (see text for explanation). Source: Author's elaborations.

### *3.6 Scenario TFT=1.40 (and compensating immigration)*

Same as before, but now fertility remains constant at *TFR*=1.4 (for the Italians; the fertility of the foreigners is assumed to be constant at $TFR_f$=2.4 in all scenarios). Once again, a constant influx of immigrants (about 140 thousand per year) eventually stabilizes the population, at about 40 million (part a). Everything else is basically the same as before, only slight worse: more ageing (part *b*), higher costs related to ageing (part *c*), and many more foreigners, 20%, plus another 32% of foreign origin: eventually, less than 50% of the population of Italy would be made of "Italians of Italian origin".

Fig. 3.6 - Demographic consequences of the scenario *TFR*=1.40




*=Reference values (see text for explanation). Source: Author's elaborations.

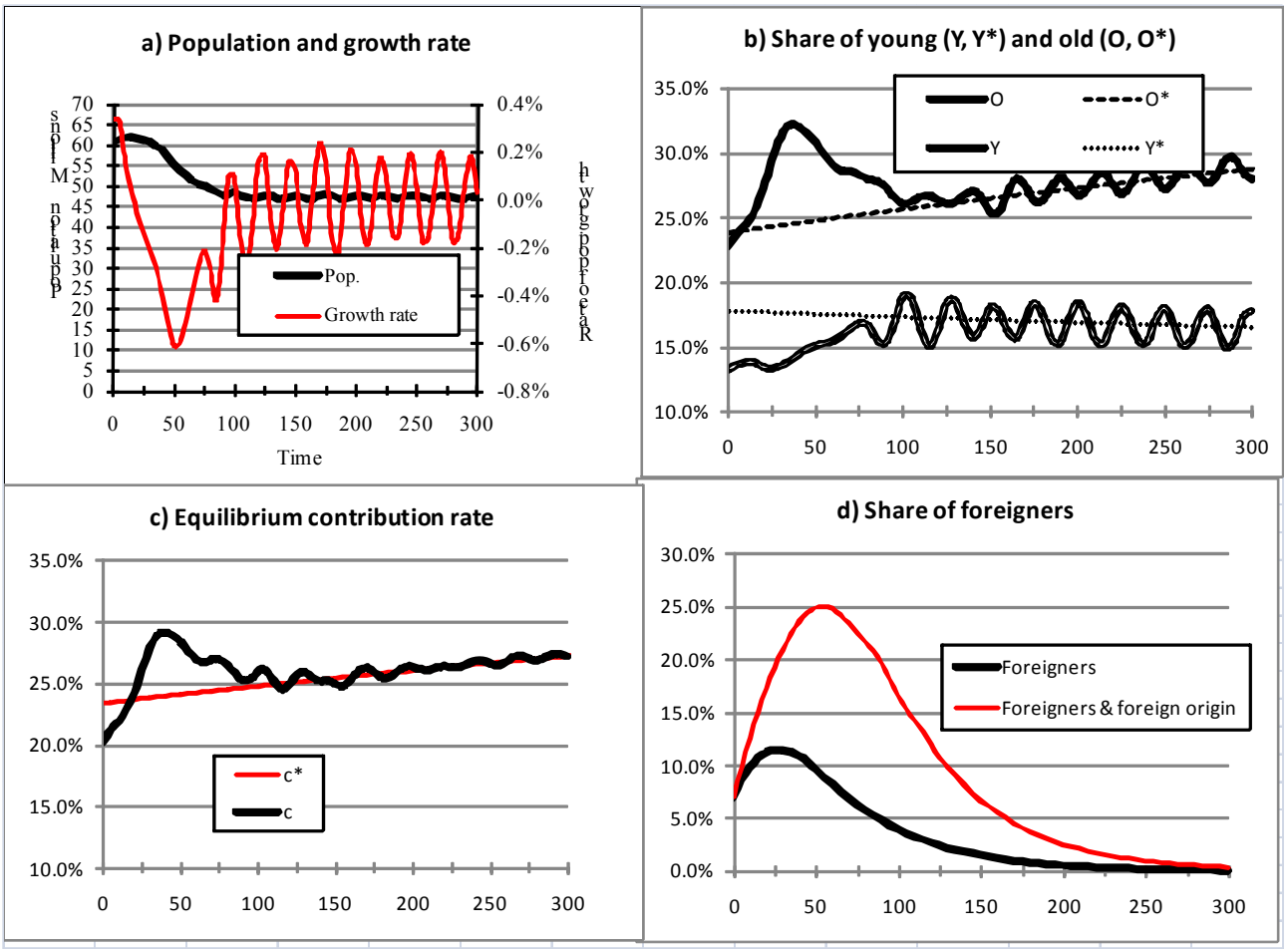
*3.7 Scenario TDT (Third Demographic Transition - immigration is high initially, but eventually vanishes, while the TFR increases gradually and eventually stops at 2.06)*

A perhaps more realistic scenario combines two opposing trends: immigration is high initially (300 thousand immigrants per year), but decreseas steadily each quinquennium, and dries up in 50 years. At the same time, fertility increases regularly, from 1.40 to 1.45, then 1.50, etc, each quinquennium, until it eventually reaches 2.06, where it stops (but with oscillations).

The population living in Italy eventually stabilizes at about 48 million (down from the current level of 60 million - part a). The proportions of young and old once again converge on their reference values (part b), but these reference values are not constant, because threshold ages are not adapted to the increases in $e_0$. Therefore, the cost of ageing, after the initial hump (present in all scenarios) and the subsequent decline, eventually sets on a steadily rising trend.

The share of foreigners reaches 11% (and foreigners plus population of foreign origin reach 25%), but the declining immigration eventually curbs the presence of foreigners in Italy, and, not surprisingly (given these assumptions), they tend to disappear in the long run.

Fig. 3.7 - Demographic consequences of the scenario "Third Demographic Transition"




*=Reference values (see text for explanation). Source: Author's elaborations.

## 4. Order, please

These scenarios are probably already too many for a reader to simultaneously dominate them all, and still they are only seven, while future possible outcomes are instead innumerable. One could go on forever imagining variants, exceptions, reversals of trends, etc. But let us instead stop here, and try to summarize what we have learnt from the exercise.

The first thing is that reference values are informative: in several scenarios, they tell us exactly where we are heading; in others (those with a perennial influx of immigrants - a rather unlikely possibility, in my opinion) they provide nonetheless a very good approximation. In other words, we can decide *now* how large the share of each age group will eventually be (by choosing the proper threshold ages α and β), and how costly the process of population ageing is eventually going to be (by choosing the proper relative standards $y$ and $o$).

The second conclusion is that there are in fact two important decisions about threshold ages: their initial level (here, for example, α=15 and β=65) and their evolution over time, considering that $e_0$ will, in all likelihood, increase, and that in some scenarios (not considered here) this increase could be very substantial, up to 100 years or more (Vallin and Meslé 2010). Living longer is a luxury, and luxuries cost: by adapting threshold ages (my favorite option, incidentally) we are implicitly deciding that we want to pay the price by spending more time at work. Alternatively, we can lower $o$ (e.g. pension benefits), or increase taxes and contributions (our $c$, in these simulations), or combine these options. The only thing that we cannot do is close our eyes and pretend that nothing is happening to our age structure.

Adapting threshold ages can, at least in principle, eliminate altogether the part of ageing that is due to increased longevity and that I have here measured with the implicit long term contribution

rate c*. But past oscillations in fertility and migration (and, to a much lesser extent, mortality) have caused irregularities, sort of waves, in the age structure of the Italian population - and, indeed, of most other populations in the western world. When these distortions produce a surplus of adults, there is a "demographic bonus", that is a phase characterized by more workers than usual, more savings, and a lower pension burden (but, also typically, more out-migration, because only rarely can local labor markets absorb a substantial increase in the number of young workers - see e.g. Salinari and De Santis 2011). This paper proposes a measure of the demographic bonus ($\Delta_t = c^* - c_t$; see eq. 4), which is a novelty, to the best of my knowledge. But its very definition (of a deviation from the mean) implies that a demographic bonus is only a temporary phase, which will sooner or later turns into its opposite, a demographic malus: this happens when the adults get old. The two phases may be far away (up to a hundred years, e.g. in the case of the demographic transitions of the past), which may create obstacles in detecting their connections - but with a very long observation (or, as in our case, simulation) period, they appear more clearly for what they are: the peaks and troughs of a long wave (or, sometimes, or a series of waves) that twists the age structure of a population.

Against this background, can immigration "solve" the ageing problem, in Italy or elsewhere? In order to simplify the answer let us just consider the evolution of *c*, our equilibrium contribution rate (part *c* of Figures 3.1 to 3.7). In all cases, this implicit tax of ageing will pass from 20% (current level) to about 30% (in 40 years or so) and decrease subsequently. What happens later on depends essentially on whether or not we adapt threshold ages: if we do, costs will eventually turn out to be relatively low ($c^*$=23%), and their underlying trend will be constant; if we do not, costs will rise, without any predetermined ceiling. In all of our scenarios, the impact of migration is almost negligible.

An incorrect, but simple, way of summarizing what happens in the 300 year of the simulation is as follows:

a) consider the value of *c* in each period and in each of our scenarios;

b) for in each period, consider the difference in *c* between each scenario and our benchmark (scenario 3.2: "Utopian, no migration"): the larger the difference, the worse the examined scenario is with respect to our benchmark;

c) for each scenario, sum these differences for 300 years.

The last passage is the weak part of the procedure, because, of course, percentages cannot be added, unless they refer to the same quantity. But we will imagine that they refer to a representative individual in each of the 300 years considered: in which scenario is this representative individual best (or, at least, comparatively better) off? The answer is in table 4.1.

Table 4.1 - Cumulative differences, over 300 years, in the equilibrium contribution rate between each scenario and the benchmark (Utopian, no migration)

| | | Sum of gaps | Highest | Highest share of | |
|---|---|---|---|---|---|
| **Scenario** | **(Section)** | **in c (1)** | **c (2)** | **Foreigners** | **F.+foreign origin** |
| TFR=1.4, no migration | (3.1) | 20.8 | 32.2% | 7.0% | 11.3% |
| Utopian, no migration (Ref.) | (3.2) | 0.0 | 31.3% | 7.0% | 10.8% |
| TFR=2.06 | (3.3) | 6.2 | 32.0% | 7.0% | 10.8% |
| TFR=1.85 | (3.4) | 6.0 | 30.9% | 7.5% | 20.5% |
| TFR=1.6 | (3.5) | 6.6 | 29.8% | 14.5% | 39.9% |
| TFR=1.4 | (3.6) | 7.5 | 29.6% | 19.1% | 52.5% |
| Third demographic transition | (3.7) | 5.0 | 29.2% | 11.5% | 25.0% |

1) Each unit can be interpreted as an *extra* year of work lost by the representative individual, because of the increase in the implicit cost of ageing. The loss is calculated with respect to the benchmark scenario (Utopian, no migration). Higher values mean higher costs, brought about by that combination of age structure and threshold ages.

2) In the next 100 years

Source: Authors' simulations.

What emerges, in synthesis, is that if the population eventually disappears (scenario "TFR=1.4, no migration"), it goes through a long period of accentuated ageing: the equilibrium contribution rate will be high in all the years, and, cumulatively, the cost of ageing will be huge.

If the population does not eventually disappear, but threshold ages are not adjusted to the longer life span, there will be a price to pay, as anticipated. This price does not change too much in the scenarios 3.3 to 3.6, but it is somewhat lower if fertility is relatively high and, therefore, the compensatory (by assumption, constant) influx of migrants is low or even null: the range is between 6.0 and 7.5 (in scenario 3.6, with *TFR*=1.4 *and* compensatory, constant immigration). Incidentally, the scenarios with immigration imply that the share of foreigners in the population will increase considerably, in some cases up to levels that it would probably be difficult, if not impossible, to manage.

Things are remarkably better, however, if migration remains relatively strong for a few years, and declines slowly while fertility increases, up to the replacement level (Scenario "Third Demographic transition"). In this case, the additional cost would reduce to 5 (extra years of work of the representative individual, over the 300 years considered). But, from the point of view of this indicator (total costs over the next 300 years), the best option is by far our benchmark ("Utopian, no migration"). It requires no immigration at all: only that fertility starts to increase now (and eventually reaches 2.06) *and* that threshold ages be adjusted as life expectancy increases.

In short, the conclusion hta we can derive from all this is that Italy can do without immigrants, if fertility and threshold ages adapt to the new circumstances. And, conversely, if fertility and threshold ages do not adapt, immigration can do very little to solve our ageing problem.

But this does not mean that we should close our frontiers? Not at all: especially in the (relatively) short run, immigration can prove beneficial. In order to see this, consider, in table 4.1, the highest level that our cost indicator *c* will likely reach in the future, presumably in about 40 years. This cost will be high (about 30% in all cases), but lower in some scenarios (down to 29%), and higher in others (up to 32%). The lowest, and best, case is that of the "Third Demographic Transition" scenario, which assumes that immigration continues for a while, albeit declining, while, at the same time, fertility increases. Although the differences with other scenarios are modest, and although, in all cases, a substantial worsening in comparison to how things stand now ($c_{2010}$=20.3%) cannot be avoided, the table does show that immigration acts in the right direction, even if its effects are only temporary.

## 5. Conclusions

Ageing may be a predicament, but ageing from above (i.e. the long term effects on the age structure caused by increases in longevity) can and, in my opinion, should be countered, or even annulled, by adjusting threshold ages - which basically means by working longer. This does not seem to be too demanding, since the required variations in the retirement age are comparatively modest, and, empirically, the increases in life expectancy have been accompanied by an improvement in health conditions at all ages, also favored by several ancillary conditions (e.g. higher education, fewer dangerous and wearing occupations, better nutrition, etc. See e.g. Lutz and Scherbov 2005; Salvini, and De Rose 2011).[14]

What remains, then is the ageing caused by fertility reduction: within limits, the negative effects of this process can be reduced by immigration. But this option remains essentially a palliative: its effects are modest and they are felt only in the short term, demographically speaking,. Immigration is not, and cannot possibly be, *the* remedy for a society that seems to be incapable of facing its

[14] There are also worries of a potentially negative impact of this on labour productivity, but empirical results are still far from clear; see e.g. Skirbekk (2004) and Prskawetz, Skirbekk and Lindh (2005).

structural problems, especially a pathologically low fertility and the indecisions and delays in introducing the several structural adjustments that ageing demands.

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