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EXTENDING THE RETIREMENT AGE FOR PRESERVING THE COSTITUTIVE PENSION SYSTEM MISSION

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Mauro Visaggio

EXTENDING THE RETIREMENT AGE FOR PRESERVING THE COSTITUTIVE PENSION SYSTEM MISSION

ABSTRACT

This paper examines some issues relating to the establishment of defined contribution pension system. First, it shows that the defined benefit pension system could successfully counteract the financial un-sustainability of the pension system, such as defined contribution pension system. Second, it notes that defined contribution pension system requires the pension amount to be endogenous and, as a consequence, the abandonment of the constitutive aim of the pension system e.g., consumption smoothing. Third, it argues that the extending of the retirement age may counteract the aging of the population and achieve financial sustainability, along with the individual well-being.

INTRODUCTION

Since the mid-eighties of the last century, most industrialized countries have experienced problems in the financing of pension systems as a result of ageing population, short-sighted political pre-commitments and economic slowdown (Börsch-Supan, 2006; Barr, 2006a). Furthermore, the 2008 financial crisis and the following sovereign debt crisis further exacerbated the trade-off between the financial sustainability of pension systems and the universal extension of life expectancy. During the last two decade, economic theory has suggested three systemic reforms to face these issues. First, the switch to a Fully Funded Defined Contribution scheme (FF, hereafter) that in the real world, however, has proven not feasible because of the unbearable transaction costs. Second, the reshaping of the Defined Benefit pension scheme (DB, hereafter) through parametric reforms consisting in adjustments in contribution rates, replacement rates or retirement age. Third, the establishment of a hybrid pension system that emerged from a compromise between DB and FF, named Notional Defined Contribution pension scheme (NDC, hereafter).

In the literature two groups of contenders face each other as regard to the structural differences between NDC and DB, the circumstances under which DB can perform as NDC and, finally, the capability of NDC to solve, once and for all, the financial problems affecting pension systems.

On one side, the proponents of NDC claim that it makes a clean break with DB and that NDC, unlike the DB, is isolated from all risks that undermine pension systems (Kruse and Palmer, 2006; Palmer, 2000, 2006a; Settergreen, 2001). However, the traditional proposed NDC contains in itself a very strong characteristic: the underlying pension policy requires pension amounts to be endogenous so as to fulfill the financial balance of the system. Alternative pension policies sharing differently the financial and/or physical burden of the demographic shock current and future generations are completely discarded.

On the other side, the skeptics of the healing properties of the NDC argue that boundaries between the two pension systems are labile and uncertain, that even in the NDC political and demographic risks might create financial unsustainability (Barr, 2004a; Barr, 2004b; Börsch–Supan, 2006; Diamond, 2005a), and that an appropriate reshaping could allow the DB to work just like the NDC.

Actually, a long time ago Musgrave (1981), showed well in advance that a variety of pension policies can be implemented in DB and, particularly, stressed the need of automatic adjustments in contribution and/or replacement rates for counterbalancing economic and demographic shocks. However, given the peculiar historical context, he did not capture the effect of the lengthening of longevity, a topic that on the contrary, in the last decade has become central to the debate.

Finally, in the recent years a lively discussion about making retirement age an endogenous variable in pension systems takes place. Up to now, however, on this specific point no general agreement emerges. Some authors maintain that this measure should be an essential part of pension reform that would reduce the long-run deficit (Magnani, 2016; American Academy of Actuaries, 2010; Liebman, MacGuineas and Samwick, 2005; Poole, 2004; Cremer, Lozachmeur and Pestieau, 2006; Pestieau, 2004). Others claim that it is a dispensable policy option (Diamond 2005b, 2005c; Diamond, Orszag, 2004).

This paper investigates two issues related to the ageing of population. First, it analyzes both the structural differences between the DB and NDC system and the conditions under which they can both ensure the financial sustainability of pension systems. Second, it examines whether between the constitutive goal, *i.e.*, individual well-being, and the financial goal, *i.e.*, long run financial sustainability of pension systems, arises a trade-off and, additionally, under which conditions the trade-off can be overcome.

Section 2 presents the basic features of the economy that recalls the traditional overlapping generations model properly modified so as to capture the change in longevity; section 3 and 4 examine the pension policies that can be carried out by policymakers in order to fulfill their final goals in the DB and NDC respectively; section 5, finally, compares the features and properties of two pension schemes.

THE BASIC FEATURES OF PENSION SYSTEMS

This section sketches the basic characteristics of pension systems *i.e.*, the demographic structure, the management of instrumental pension variables and, finally, the overall risks affecting the economic system and, subsequently, the pension system.

The demographic structure

The demographic structure of the economy – described in Figure 1 – refers to the overlapping generation model developed by Samuelson (1958) and Diamond (1965) properly modified for capturing the effects of longevity changes on the dynamics of pension systems. This is because, as it will be shown in the next section, longevity is one of the most relevant factors determining both the financial solvency of pension systems and individual well-being. In the standard overlapping generation model, the generations overlap each other along a succession of discrete periods, live for two or three periods, and, finally, die at the end of the second or third period.

Let us now consider an economy that proceeds with discrete interval *i.e.*, t, $t+1$ $t+2\ldots$, and, in which, one interval is divided into j sub-interval each of which lasts $1/j$ of the interval. Suppose that the generation are constant *i.e.*, $n=(N_t - N_{t-1})/N_{t-1}$ so that $N = N_{t-1} = N_t$ and that they stay in the economy not longer than two periods. The individuals of generation t entirely pass the first period (which does not necessarily coincide with a temporal interval) working. In the second period, individuals go through three phases: in the first phase they spend time to continue working; in the second phase they retire and, finally, at the beginning of the third phase they die and leave the economy before the end of the period. From the previous assumptions, it follows that the individual lifespan of the generation $t-1$, Ω_{t-1}, − which captures the longevity of the individual − is divided into one work phase and one retirement phase because, by hypothesis, childhood is ignored.

In literature, sometimes, longevity is endogenously determined such as, for instance, by Pestieau, Ponthiere and Sato (2006) where it depends on health investment. In our model we simply assume that it is exogenously determined.

The *retirement age*, $R_{t-1} = \Omega_{t-1} - L_{t-1}$ − which is an instrumental pension variable − defines and *de facto* coincides with the *working phase length* which is made up by k sub-periods each of which lasts $1/k$. Additionally, it is assumed that the retirement age at time *t*, L_{t-1}, is fixed and enforced at the beginning of period $t-1$ when Ω_{t-1} is revealed in previous period. Moreover, it is assumed that $L_{t-1} = L_t = L_0$: in other words, when the length of the work phase is changed for the pensioners of generation $t-1$ it also applies to future generations.

Finally, the *retirement phase length* is made up by h sub-periods each of which lasts $1/h$. As a consequence of the above assumptions, the *length* of the period in which individuals are not any more in the economy is made up by ω sub-periods each of which lasts $1/\omega$ (obviously $k+h+\omega \leq 2$).

It is worth to stress that in this paper the retirement age coincides with the *mandatory* retirement age. Our analysis does not take into account the issue of early voluntary retirement age often addressed by some authors (Diamond, 2005a, 2005c; Cremer, Lozachmeur and Pestieau, 2006).

Under the above assumptions, it follows that $0 < L_{t-1} < 2$, $0 < R_{t-1} < 1$ and $\Omega_{t-1} = L_{t-1} + R_{t-1} < 2$. We recall that, the subscript on variables L_{t-1}, R_{t-1} and Ω_{t-1} refer to generation and not to time. At time *t*, individuals of generation *t* receive in advance the full amount of real wage earned during their lifetime.

A measure of the ageing population may be represented by the *old age dependency ratio*, DR_t^{OA}, which at the time *t* is equal to the ratio between the number of generation $t-1$ retirees adjusted for the duration of their retirement phase, and the number of workers of generation *t*, adjusted for the duration of their working phase:

$$DR_t^{\mathrm{OA}} = \frac{N\,\Omega_{t-1} - N\,L_{t-1}}{N\,L_t} = \frac{R_{t-1}}{L_t} = \frac{\Omega_{t-1}}{L_0} - 1 \tag{1}$$

Since $R_{t-1} = \Omega_{t-1} - L_{t-1} = \Omega_{t-1} - L_0$, both $L_{t-1} = L_0$ and R_{t-1} are instrumental pension variables, and, as a consequence, DR_t^{OA} is not *strictly* a demographic variable since it depends on policy makers' choice about L_0. By managing L_0, policymakers can affect the structure of population by age and, eventually, maintain constant DR_t^{OA} when Ω_{t-1} changes.

The management of pension system

At time *t*, policymakers must manage the pension system, which has already been set up in previous periods, carrying out two tasks:

1. choose the final objectives of the pension system and to prioritize among them if a trade-off will emerge;
2. define a pension policy plan to achieve the final objectives set.

In general, policy-makers with regard to pension systems pursue two main objectives.

The constituent objective of pension systems should be a high level of *individual* *well-being*, that is to say that people should enjoy a level of consumption that is as stable as possible over time and, in particular, between the work phase and the retirement phase. This objective is closely related to a high standard of living measured in terms of real wage after tax in each sub-period. Obviously, a high level of economic well-being is certainly associated with a high standard of living.

An additional goal of pension system should be the *pension system financial stability i.e.*, the fulfillment of a balanced budget of the pension system so as to ensure its long-term sustainability and, consequently, the sustainability of the public debt so as to prevent unfair backward intergenerational redistributions.

In order to achieve the final goals, policymakers must manage the pension instrumental policy variables. On the one hand at time *t*, a worker of generation *t* pays contribution c_t in each sub-period of L_t while, on the other hand, at time *t*, a retiree of generation $t-1$ receives a pension amount p_t in each sub-period of R_{t-1} where the subscript on the variables p_t and c_t refers to time.

Obviously, the pension system budget balance, B_t^{PS}, is equal to the difference between aggregate pensions and aggregate contributions:

$$B_t^{\mathrm{PS}} = P_t - C_t = N\left[\left(\Omega_{t-1} - L_{t-1}\right)\, p_t - L_t\, c_t\right] \tag{2}$$

When a budget deficit occurs, that is $B_t^{\mathrm{PS}} > 0$, it must be financed by government bonds or by general taxation. We assume that budget deficits are financed by bonds, so that the pension system produces a backward intergenerational redistribution. In conclusion, policymakers manage three instrumental pension variables *i.e.*, c_t, p_t and L_{t-1} (since, given Ω_{t-1}, R_{t-1} is derived accordingly) so that let $\pi_t^{\mathrm{PS}} = \left(c_t,\ p_t,\ L_{t-1}\right)$ be a *pension policy plan* on a pension system at period *t*.

The overall risks affecting the economy

The economy is subject to demographic, economic and political risks whose manifestation, in turn, generates demographic, economic and political shocks that affect the fulfillment of the two major goals.

1. The *demographic risk* is the uncertainty surrounding the ageing population (in relative term): an increase (decrease) in Ω_{t-1} – a "negative" ("positive") shock – produces an increase (decrease) in retirement phase as long as L_{t-1} does not change. With respect to this point it is worth to stress in Barr's (2004b) words this aspect:

   "The fact that people live longer is wonderful. To talk about the "ageing problem" is grotesquely to miss the point. The problem is not that people are living longer but that they retire too early".

2. The *economic risk* is the uncertainty about economic activity: an economic slowdown (growth) – a negative (positive) shock – determines a reduction (increase) of γ.

3. The *political risk* is the uncertainty surrounding the policymakers' ability or willingness to manage the instrumental pension variables in order to fulfill the financial goal (for an analysis of political risk see Diamond, 1996, and Shaven & Slavov 2006). The political risk has two main manifestations. A first negative political shock might occur during the establishment phase of the pension system due to the policymakers' inaccuracy or unwillingness to fix the instrumental variables consistent with the financial goal from the very beginning. A second negative political shock might occur during the implementation phase of the pension system when policymakers do not update the instrumental pension

variables, through discretionary or automatic interventions, in order to offset the changes in demographic and economic variables so as to continue to fulfill the financial goal.

The mechanism for determining the amounts of pensions distinguishes two pension schemes: the defined-benefit pension scheme (DB) and defined contribution pension scheme (CD).

THE DEFINED BENEFIT PENSION SCHEME

In DB, pensions for current retirees are financed through contributions paid by current workers and, moreover, their amount derives from a formula related to *gross* wage. At time t, on the one hand, in each sub-period of L_t workers of generation t earn a gross wage equal to w_t, whose growth rate is constant and equal to $\gamma = (w_t - w_{t-1}) / w_{t-1}$, and in each sub-period of L_t pay a contribution c_t for an amount equal to:

$$c_t = \tau_t w_t \tag{3}$$

where τ_t is the contribution rate. On the other hand in DB, retirees of generation $t-1$ receive in each sub-period of their retirement phase a pension p_t for an amount equal to:

$$p_t = \sigma_t (1-\tau_{t-1}) w_{t-1} \tag{4}$$

In other words, retirees of generation $t-1$ receive in each sub-period of their retirement phase a pension for an amount linked to real after tax wage of the previous period through a replacement rate equal to σ_t.

Let us now analyze the effect of the demographic shock on the functioning of the pension system and, furthermore, examine how this shock affects the achievement of the two objectives and whether the policy makers are able to achieve both goals when this shock appears. As we will show, with regard to the latter issue, the result depends on which objective has priority over the other. Two cases are examined: in the first case, policymakers assign priority to the financial goal, in the second one, to the constitutive goal, that is, the well-being of individuals.

The financially balanced DB

In the financially balanced DB, $\mathrm{DB}^{\mathrm{B,DB}}$, policymakers prioritize the financial goal so that, given (4), equation (2) becomes:

$$B_t^{\mathrm{B,DB}} = N\left[\left(\Omega_{t-1} - L_{t-1}\right)\sigma_t\,(1-\tau_{t-1})\,w_{t-1} - L_t\,\tau_t\,w_t\right] = 0 \tag{5}$$

In this pension scheme, equation (5) is a constraint that the pension plan has to satisfy at each period and recalls that the three instrumental policy variables cannot be set independently: policymakers can choose two, but the third must be left as endogenous variable. Then, at each time $t,$ given Ω_{t-1}, the pension policy plan is $\pi_t^{\mathrm{B},\,DB} = \left(\sigma_t\,,\tau_t,\,L_{t-1} = L_{t-1} = L_0 \mid B_t^{\mathrm{B,DB}} = 0\right)$.

In equilibrium – that is when demographic and economic variable do not change – the instrumental pension variables do not change as well so that the pension policy plan is $\pi_{t+j}^{\mathrm{B},\,DB} = \left(\tau_{t-1} = \tau_t = \bar{\tau};\ \sigma_{t-1} = \sigma_t = \bar{\sigma};\ L_0;\ \bar{R} \mid B_{t+j}^{\mathrm{B,DB}} = 0\right)\quad \forall\ j = 1,2,3,\dots$. Therefore, at time t, given equations (3) and (4), the internal factor of return of individual of generation $t-1,$ IFR_t^B, of $DB^{\mathrm{B,DB}}$ is:

$$1 + IRR_t^{\mathrm{B,DB}} = \frac{P_t}{C_{t-1}} = \frac{\bar{R}\ \bar{\sigma}\left(1-\bar{\tau}\right)w_{t-1}}{L_0\ \bar{\tau}\ w_{t-1}} = \frac{L_0\ \bar{\tau}\ w_t}{L_0\ \bar{\tau}\,w_{t-1}} = 1+\gamma \qquad \forall t \tag{6}$$

where $IRR_t^{\mathrm{B,DB}}$ is the internal rate of return of both retirees of generation $t-1$ and future generations as long as shocks do not occur. Therefore the internal return factor that satisfies the balanced budget goal is equal to the growth factor of the tax-base, that, in turn, is exogenously determined by γ irrespective of Ω_{t-1}. Not surprisingly, it coincides with the Aaron-Samuelson condition, when population is stationary, since $\mathrm{DB}^{\mathrm{B,DB}}$ really is the traditional PAYG system (Aaron, 1966; Samuelson, 1958). Furthermore it is well known that if γ is positive, $\mathrm{DB}^{\mathrm{B,DB}}$ acts as a feasible Ponzi game.

Now we analyze the effects of the occurrence of the demographic shock on the working of $\mathrm{DB}^{\mathrm{B,DB}}$. Let us rewrite equation (5) in the following way:

$$DR_t^{OA} = \left(\frac{\Omega_{t-1} - L_{t-1}}{L_t} \right) = \frac{\tau_t (1+\gamma)}{\sigma_t \left(1-\tau_{t-1}\right)} \tag{7}$$

Equation (7) show that balancing the budget requires that two instrumental policy variables to be fixed while the third one is residually derived by (7). Three different pension policy on $\mathrm{DB}^{\mathrm{B,DB}}$ corresponds to each instrument policy variable that is left endogenous. Actually, Musgrave (1981) distinguishes four forms of $\mathrm{DB}^{\mathrm{B,DB}}$: fixed replacement rate, fixed contribution rate, fixed replacement rate adjusted, and fixed relative position. By dividing the individual's life into two parts, our analysis allows to define a further form based on ***retirement age*** as an endogenous variable.

The endogenous contribution rate policy

In the endogenous contribution rate policy on $\mathrm{DB}^{\mathrm{B,DB}}$, whether the demographic variable changes, from Ω_{t-1} to Ω_{t-1}^{1} where $\Omega_{t-1} < \Omega_{t-1}^{1}$ the value τ that satisfy the financial goal is derived by equation (7):

$$\tau_{t+j}^{\mathrm{B,DB}} = \frac{\left(1-\overline{\tau}_{t+j-1}\right)\sigma_{t+j}}{(1+\gamma)} \frac{\left(\Omega_{t-1}^{1} - L_{t-1}\right)}{L_t} = \frac{\left(1-\overline{\tau}_{t+j-1}\right)\sigma_{t+j}}{(1+\gamma)} \frac{1}{DR_{t+j}^{OA,1}} \qquad \forall\, j = 0,1,\ldots \tag{8}$$

In our model the endogenous contribution rate policy coincides with the "*fixed relative position*", favored by Musgrave (1981) since the amount of pensions depends on after-tax wage rather than gross wage. For a similar proposal see Diamond and Orszag (2004) and

Diamond (2005a, 2005b), where an equal burden of such costs between workers and retirees is proposed.

Figure 2 shows the effects of a permanent increase in longevity from Ω_{t-1} to Ω^{1}_{t-1}. At time *t* since the pension amount p_t does not change, aggregate pensions increase for an amount equal to area (*EFGH*). However, since budget must be balanced, aggregate contributions have to increase, *via* the increase of τ_t, for an amount equal to the increase of aggregate pensions: area (*ABCD*) = area (*EFGH*). Therefore at time *t* retirees of generation $t-1$ are not affected by the negative demographic shock since the increase in the aggregate amount of pensions are financed by an equivalent increase in the amount of aggregate contributions of generation t workers.

On the contrary, starting from period $t+1$, future generations bear the burden of the negative demographic shock in terms of higher contributions that they have already paid in the previous period. As a consequence, the well-being of individuals reduces with respect initial position and the well-being of individuals reduces throughout their entire lifespan.

The endogenous pension amount policy

Under this pension policy, changes in the demographic variable Ω_{t-1} impose adjustments on the replacement rate, and therefore, on pension amounts. The equilibrium value of the replacement rate follows from (7):

$$\sigma^{\text{B, DB}}_{t+j} = \tau\,(1+\gamma)\,\frac{1}{DR^{\text{OA},1}_{t+j}} \qquad \forall\, j = 0,1,\ldots \tag{9}$$

where $\tau_t = \tau_{t+1} = \tau$ land $L_t = L_{t+1} = L$. Equation (9) sets the automatic rule to counterbalance negative demographic shocks: at each period, the replacement rate equals a constant parameter (that depends on τ and γ) multiplied by the population ageing index.

Then given (9) and (4) it follows that the pension amount is equal to:

$$p_{t+j} = \left(\tau\,(1+\gamma)\, \frac{1}{DR_{t+j}^{\mathrm{OA},1}} \right) w_{t+j-1} \qquad \forall\, j = 0,1,\ldots \tag{10}$$

Figure 3 shows the effects of an increase in Ω_{t-1} and, therefore in DR_t^{OA}. As a consequence of the negative demographic shock, at time *t*, as long as the pension amount in each sub-period is maintained constant at the previous level p_{t-1} the increase in aggregate pension amount due to the increase of Ω_{t-1} is equal to area (*HBGF*). However because of balanced budget constraint and the constancy of the amount of aggregate contribution, the pension of the sub-period must be reduced so that the reduction of the aggregate pension is equal to area (*ADCB*) so that area (*ADCB*) = area (*EFGH*).

In conclusion, under this pension policy the negative demographic shock produces a permanent decrease in pension amount and therefore, also in this case, reduces the well-being of future generations.

The endogenous retirement age policy

In the endogenous retirement age policy on $\mathrm{DB}^{\mathrm{B,DB}}$, L_{t-1} adapts to offset adverse changes in longevity, according to the rule that derives from (7):

$$L_{t-1+j}^{\mathrm{B,DB}} = \left(\frac{1}{\sigma + \tau\,(1+\gamma)} \right) \Omega_{t+j} \qquad \forall\, j = 0,1,\ldots \tag{11}$$

Rearranging (11) in more appealing terms:

$$DR_{t+j}^{\mathrm{OA},1} = \frac{\sigma}{\tau(1+\gamma)} = \overline{DR}^{\,\mathrm{OA},1} \tag{12}$$

i.e., policymakers by adjusting the retirement age can maintain the population ageing index unchanged. In other words they make the ageing a *relative* rather than *absolute* concept.

Figure 4 shows that the increase in Ω_{t-1} produces an increase in the aggregate pension for an amount equal to the area (*ABCD*). As a consequence – given the balanced budget constraint the contribution and the replacement rates – as a consequence the retirement age must increase so to reduce the aggregate pension for an amount equal to area (*EFGH*) where area (*ABCD*)= area (*EFGH*).

Under this pension policy, the manifestation of negative demographic shocks produces a burden on individuals in terms of a *greater working effort* since it imposes a later retirement so that individuals must work a longer time for continuing to get the same pensions and paying the same contribution as before. However, this pension policy in front of the greater working effort is able to reconcile fully the goals of balanced budget and the well-being of individuals throughout their entire lifespan. Significantly, in this case the living standard remains to a level as it was before the adverse shock. We finally recall that Cremer and Pesteau, 2003, Cremer, Lozachmeur and Pesteau, 2006, show that increasing the age of retirement can be a Pareto improving reform in countries where retirement age is too low, whereas, Casamatta, Cremer and Pesteau 2007 show a setting where political consensus can remove the double burden of payroll tax and reduction in pension rights.

Summarizing, in DB the political risk vanishes since the financial goal has the priority on the well-being of individuals. In these circumstances, the occurrence of a negative demographic shock produces inevitably a burden on individual of current and future generations: a *financial burden* in terms of greater contributions and/or lower pensions that produce a decrease of the well-being of individuals; a *physical burden* in terms of a greater working effort in order to maintain a constant the individual well-being.

The financially unbalanced DB

In the financially unbalanced DB, DB , the balanced budget constraint does not constitute an additional goal. All instrument policy variables are fixed *ad hoc i.e.*, $L_{t-1} = L^{\text{A/H}}$,

$\tau_{t-1} = \tau^{\text{A/H}}$ and $\sigma_{t-1} = \sigma^{\text{A/H}}$, while the pension budget balance is left endogenous. We recall that the "ad hoc provision" approach is briefly discussed, and drastically rejected, by Musgrave (1981).

It is assumed that the *ad hoc* pension policy produces a budget deficit, $\text{DB}_t^{\text{UN, DB}}$, equal to:

$$\text{DB}_t^{\text{UN, DB}} = \left(\Omega_{t-1} - L^{\text{A/H}}\right)\left(1 - \tau^{\text{A/H}}\right)\sigma^{\text{A/H}}\ w_{t-1} - L^{\text{A/H}}\,\tau^{\text{A/H}}\ (1+\gamma)\,w_{t-1} \tag{13}$$

The internal return factor associated with DB is:

$$\left(1 + RR_t^{\text{UNB/DB}}\right) = (1+\gamma)\left[\left(\frac{\Omega_{t-1} - L^{\text{A/H}}}{L^{\text{A/H}}}\right)\frac{\sigma^{\text{A/H}}}{\tau^{\text{A/H}}}\right] \tag{14}$$

In an unbalanced DB-PAYG scheme, the internal return factor is affected by instrument policy variables and longevity. Fortunately for current generations, but unfortunately for future generations, current generations are more than fully covered against negative demographic shocks. Indeed longevity, from the current retirees'view, does not entail a loss. Contrariwise, it results in a nice gain: the more longevity lengthens, the more the internal return factor increases, the better retirees are (in all respects). The ageing of population, therefore, constitutes an underhand mechanism for redistributing resources, via pension system, from future to current generations.

THE NOTIONAL DEFINED CONTRIBUTION PENSION SCHEME

In NDC at time t, on the one hand, current retirees of generation $t-1$ receive pensions derived from a contribution related formula (as in FF) and, on the other hand, workers of generation *t* finance those pensions through their contributions (as in DB).

First, at time $t-1$, contributions of workers of generation $t-1$ plus the interests accrued on the basis of the internal rate of return, RR_{t-1}^{DC}, fixed exogenously by policymakers, are recorded on an individual *notional account*. World Bank (2001) labeled this pension system the "*third way*" between DB and DC. For a comprehensive analysis of NDC see Palmer (2000). For a general classification of pension systems see Lindbeck and Person (2006).

Second, at period *t*, individuals of generation $t-1$ enters in the retirement period with an endowment of notional capital, W_{t-1}, equal to:

$$W_{t-1}^{DC} = L_{t-1}\,\tau_{t-1}\,w_{t-1}\left(1+RR_{t-1}^{DC}\right) \tag{15}$$

and receive a pension amount equal to the ratio between the notional capital, and the length of the retirement life:

$$p_t = \left(\frac{1}{\Omega_{t-1}-L_{t-1}}\right) W_{t-1}^{DC} = \left(\frac{1}{\Omega_{t-1}-L_{t-1}}\right)\left(L_{t-1}\;\tau_{t-1}\,w_{t-1}\right)\left(1+RR_{t-1}^{DC}\right) \tag{16}$$

In NDC the pension system budget B_t^{DC} is given by:

$$B_t^{DC} = \left(\Omega_{t-1}-L_{t-1}\right)p_t - L_t\,\tau_t\,w_t \tag{17}$$

The equation (17) does not imply *per se* a balanced budget, until the pension policy is defined. In NDC policymakers control an additional instrument variables, the internal rate of return, so that the pension policy plan is $\pi_t^{DC} = \left(p_t,\ \tau_t,\ L_{t-1}, RR_{t-1}^{DC}\right)$. In a similar way to DB, in NDC both pension amount and budget balance depend on which goal has the priority on the other.

The financially balanced NDC

In the financially balanced NDC system, NCD^{B} the policy ensures a balanced budget continuously:

$$B_t^{DC} = \left(\Omega_{t-1}-L_{t-1}\right)p_t - L_t\,\tau_t\,w_t = 0 \tag{18}$$

and, as a consequence, a backward intergenerational redistribution is ruled out by definition. Fulfilling this task requires a two-steps decision-making process.

In the first step, the internal return factor must be fixed. Given (18) it follows that in equilibrium, *i*.e., $\tau_t = \tau_{t-1} = \tau$, $\Omega_{t-1} = \Omega_t = \Omega$ e $L_t = L_{t-1} = L$, it must be:

$$\left(1+RR_t^{\text{B-DC}}\right) = \left[\frac{L_t\,\tau_t\,w_t}{L_{t-1}\,\tau_{t-1}\,w_{t-1}}\right](1+\gamma) = (1+\gamma) \tag{19}$$

Not surprisingly, the feasible internal return factor is equal to the growth factor of the taxation base.

In the second step, the recognition of an automatic adjustment rule is needed to satisfy the balanced budget constraint continuously. However, once the internal return factor has been fixed, the pension amount does not necessarily need to be endogenous. Indeed, from equation (18) it follows that in NCD^{B}, the pension amount is equal to:

$$p_t = \left(\Omega - L\right)\;\left(L\;\;\tau\;\;w_{t-1}\right)\left(1+\gamma\,\right) \tag{20}$$

and that one instrumental policy variable must be left endogenous. Tracing the taxonomy used for DB on NDC, three alternative pension policies can be identified.

The endogenous contribution amount policy

Suppose now that the demographic variables change from Ω to Ω^1 where $\Omega < \Omega^1$.When policymakers consider the contribution rate as endogenous, such rate adjusts according to the following rule, obtained from (18):

$$\tau_{t+1}^{\text{B,DC}} = \left(\Omega^1 - L\right)\;\;\tau \tag{20}$$

In other words, if longevity increases, in order to keep the amount of the pension equal to the level preceding the negative shock, the notional capital must increase through an increase in the contribution rate in order to neutralize the negative effect on the amount of the pensions. Thus, this approach implies that the demographic shock falls on future generations in terms of higher contributions and, therefore, in terms of a lower level of individual well-being.

The endogenous pension amount policy

In the endogenous pension amount policy on $\mathrm{NCD}^{\mathrm{B}}$, since $L_t = L_{t-1} = L$ and $\tau_t = \tau_{t-1} = \tau$, there must be:

$$p_{t+1}^{\mathrm{B,DC}} = \left(\frac{L}{\Omega^1 - L}\right)\left(\tau(1+\gamma)\,w_{t-1}\right)\left(1+RR_{t-1}^{\mathrm{DC}}\right) \tag{21}$$

This is the conventional rule that developed in the literature and implemented in some countries. Equation (21) embraces all the major properties of the conventional NDC system: actuarial fairness, transparency, political feasibility, financial viability, credibility and finally incentive to later retirement. Some authors try to better define the concept of actuarial fairness (Lindbeck, 2006; Disney, 2004; Queisser and Whitehouse, 2006). In $\mathrm{NCD}^{\mathrm{B}}$, the rate of return on contribution is not fully fair. This is why for instance Lindbeck defines DC as a "quasi-actuarially fair" system. For a general discussion on the main features of DC see Palmer, 2000, Disney, 2000b and Börsch–Supan, 2006. Further, it shows that the demographic risk fall entirely on current retirees in terms of lower pension amount. Even during the retirement period, the balanced budget constraint requires to adjust pension amounts to changes in life expectancy. Also to avoid this issue, the Swedish system introduced a balancing mechanism, a special stabilizer financed by a small percentage of contributions. Definitely, fairness is the ultimate objective of such pension system. The renunciation of individual well-being goal is the high social price to pay for financial solvency in case of external shocks when the role of pension system is simple fairness.

The endogenous retirement age policy

When the retirement age is endogenous a negative demographic shock results the policy-makers must increase the value of L to $L_t^{\mathrm{B,DC}}$. Given $p_t = p_{t-1} = p$ and $\tau_t = \tau_{t-1} = \tau$ then from (18) and given (15) and (16) it follows the retirement age that satisfy equation (18):

$$L_t^{\mathrm{B,DC}} = \left[\frac{1}{1 + \left(\frac{1+\gamma}{RR^{DC}} \right) \left(\frac{\Omega - L}{L} \right)} \right] \Omega^1 \tag{22}$$

As a consequence, when the retirement age is left endogenous the increase in longevity produces an increase in the retirement age since the term in the square bracket is constant. In these circumstances, the workers of future generations will bear the costs in terms of later retirement whereas the well-being of individual is not affected.

The above automatic adjustment rules have not been worked out in the recent literature, even if they do not seem incompatible with the key features of NDC. Even in front of external shocks, the pension policy can also play a broader role in the economy: it can guarantee the individual well-being even if, obviously, at a different degree accordingly to the choice made. As in section 3, an endogenous contribution rate imply a lower level of individual well-being than it was before the adverse shocks occurred. The choice of the retirement age as an endogenous variable seems to be an attractive response to the steady lengthening of longevity. Indeed, it can allow skipping the traditional trade-off between guaranteeing financial solvency and maintaining living standards and, at the same time, can preserve the insurance principle. In an era of population ageing a similar scenario is perhaps worth considering. On this policy option sees Barr (2004b).

Equivalences and differences between NDC and DB plans

At first, let us briefly conclude discussing the key differences between $\mathrm{NCD}^{\mathrm{B}}$ and the conventional DB *i.e.*, the financially unbalanced. In turn, the analysis of these differences underlines the need for a system based on "fairness" principles. At the end, the final core difference between NCD^{B} and DB^{UNB} stays with the decision-making process rather than to the simple mechanism of generating the pension amount. On one side, in a NCD^{B} system, the contribution related formula for generating pensions is built-up on two key elements of the decision-making process notably which of a balanced budget constraint, internalized in the pension plan, and that of an explicit automatic adjustment rule. Contrariwise, in a DB^{UNB} system, pensions are fixed in direct ratio to the workers' real wage irrespective of whether the balanced budget constraint is satisfied or not, and furthermore the system does not adjust automatically to demographic and economic shocks.

However, when DB^{B} embraces the same decision-making process as NCD^{B}, (*i.e.*, the same reaction – based on an automatic rule – to external shocks for maintaining balanced budget) then both pension systems possess the same properties and perform identical outcomes in spite of the fact that they use a different mechanism for computing pensions. At the end, the difference reduces to the outward appearance of this mechanism. World Bank (2001) and Börsch–Supan(2006) sketch out roughly this point. Cichon (1999) went further and showed the equivalence between DC and DB with respect to the endogenous pension policy. Clearly, the final aim of NCD^{B}, *i.e.* fairness, can perfectly match the basic principle of financial stability, while demographic changes in DB^{B} could result in missing the final goal, *i.e.* individual well-being, and/or financial stability.

The financially unbalanced NDC pension scheme

As we have seen, the contribution related formula for computing pension amount is not a sufficient condition to guarantee the financial viability of NDC. Indeed, discretionary policy decisions can come up frequently during the decision-making process. They can concern three main elements: the choice of the internal rate of return, the proper fine-tuning of the automatic adjustment rule and, finally, its effective enforcement of the latter. Obviously, when the theoretical conditions are met, the financial viability of the pension system follows automatically. But, in the real world, NDC is also affected by the political risk, as well as other pension systems. Let us now examine the two main sources of political risk that are still active in NDC. The literature largely points out the necessary conditions to align the effective design to the theoretical model. Having the Italian experience in mind, let us recall the most significant conditions just to exemplify the issue. First, the internal rate of return must be set equal to the salaries growth rate; second, the frequency of updating the automatic adjustment rule should be annual. Whether the updating of the rule is made at long intervals, there could raise not only financial problems but also intergenerational iniquities. Clearly, whether the life expectancy of people belonging to the first cohort of the interval is enforced to the remaining cohorts, a deficit should occur and, additionally, the actuarial fairness should be infringed. Surely, the lack of enforcing the automatic adjustment rule is the main issue which could undermine the financial viability of NDC. When policymakers renege their pre-commitments, then financial feasibility and credibility will be broken. At the theoretical level, the political feasibility relies simply on the assumption that the automatic adjustment rule is enforced by law. However, this assumption is not a sufficient condition to avoid the political risk. Indeed, political feasibility does not follow automatically when institutional links for maintaining the political pre-commitments do not exist, for instance when costly reneging on the pre-commitments take place. In other words, something that looks like what is entailed in the Stability and Growth Pact for government public deficit and debt. Certainly, this problem could worsen when NDC is designed badly or represents the only pillar of the pension system. For instance, when the updating of automatic adjustment rule is not made annually, political difficulties could arise in enforcing later and larger reduction of the pension amount. Additionally, whether other forms of pensions do not supplement the ones paid from NDC, then in the long run the dramatic reduction of the pension amount could generate a social unsustainability that, in turn, could be problematical in political terms.

CONCLUSIONS

This paper attempted to deal with some open issues risen in the literature on the differences of both NDC and DB and their capabilities to deal with the ageing of population. The main findings are the following. First, we developed a simple framework of pay-as-you-go systems where longevity is introduced explicitly so that the retirement age constitutes an additional instrument variable in the pension plan for counterbalancing economic and demographic shocks. The basic and common framework of pay-as-you go systems showed that, given an automatic stabilizer, variably defined, and given also the equivalence of contribution payments to pension benefits within the same generation, the two pension systems share the same properties and perform the same outcome. Such decision-making process (and especially the enforced balance constraint) modifies the priorities of a pension plan, first of all renouncing to individual well-being. Furthermore, alternative pension policies for sharing differently the costs of demographic shocks among current generations are not considered in literature. Developing Musgrave’s suggestion on the alternative pension policies about risksharing among generations, we show that when longevity is taken explicitly into account a new pension policy based on an endogenous retirement age can be devised. Indeed, implementing this pension policy could result in significant advantages in an era of population ageing. Actually, it can keep the population structure unchanged by increasing the retirement age. As a result, current workers bear the costs of demographic risks. Notably, a similar pension policy could fulfill not only the requirement of financial solvency but also the traditional goal of a pension system, i.e. individual well-being both for current workers (so to compensate the loss in terms of later retirement) and especially for retirees. We showed that a NDC design cannot definitively root out the political risk from a pension system. Indeed, the recent Italian experience in NDC implementation seems to indicate a recognizable inaccuracy in the design set-up. Its lack of flexibility in facing changes in economic and demographic variables may rise future unsustainability. A few general policy implications may be worked out. The ageing of population involves inevitably a redistribution issue, not only between current and future generations, but also among current generations. Indeed, we pointed out that policymakers cannot escape from following one of these routes: either to run deficits so to switch the costs on future generations; or to increase general tax revenues so to produce an intragenerational redistribution. They can also reduce pension amounts so as to charge the whole costs on retirees or increase forcibly the workers' saving by raising the contribution rate and, therefore, by charging the costs on them. Another measure is to favour or enforce later retirement. No alternative directions are on the ground but all these points could be partially applied together in adequate policy designs. Any chosen definite route reveals the specific goal that policymakers assign to the pension system and the specific underlying social contract on which the latter rests.

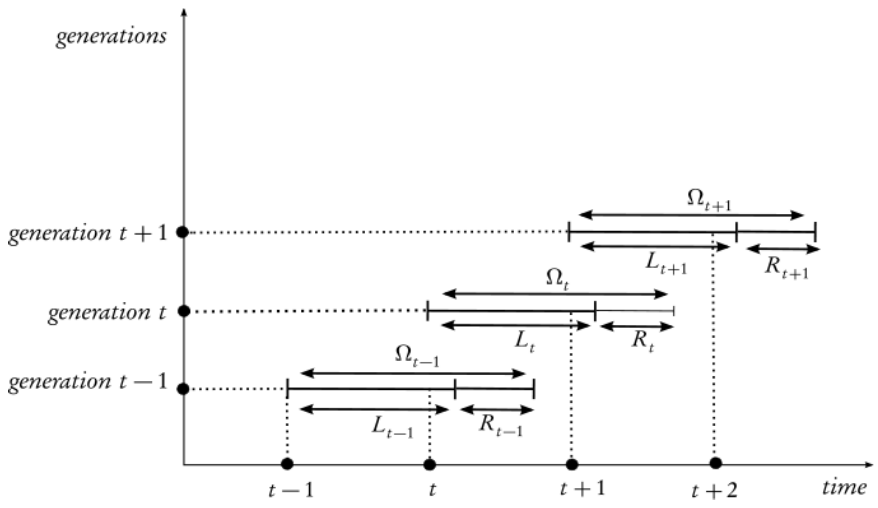

Figure 1. The demographic structure. The temporal evolution of overlapping generations based on the phase of work, retirement and life span.

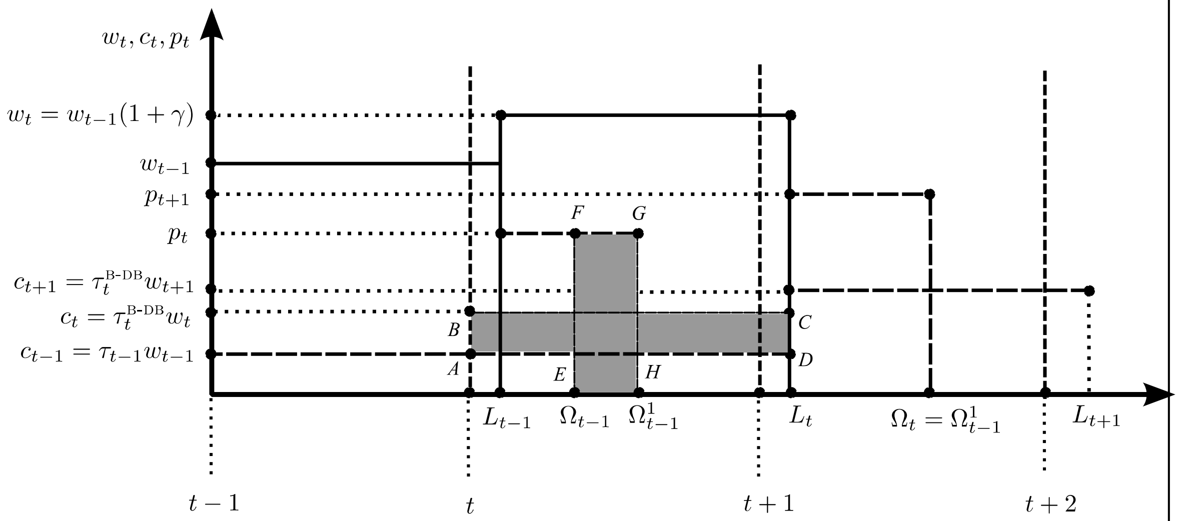

Figura 2. The endogenous contribution rate policy.

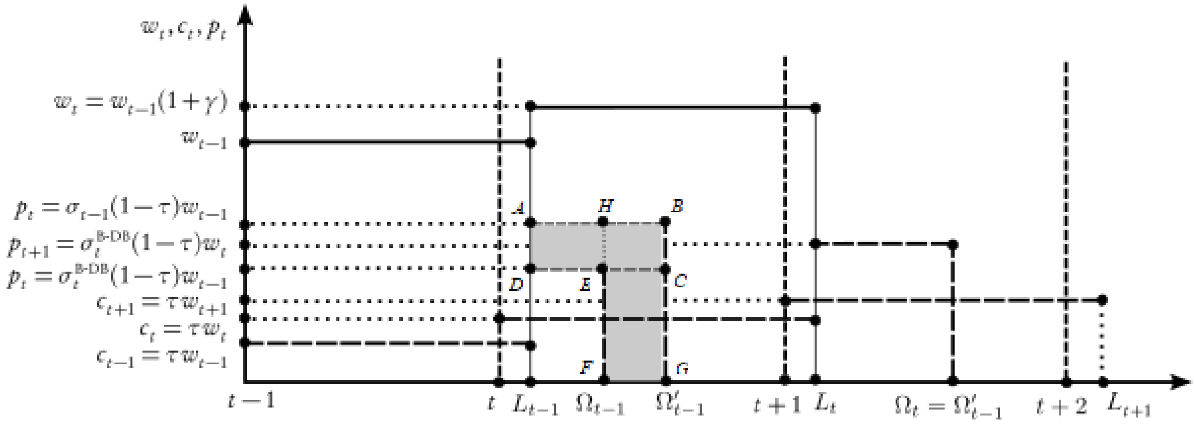

Figura 3. The endogenous replacement rate policy.

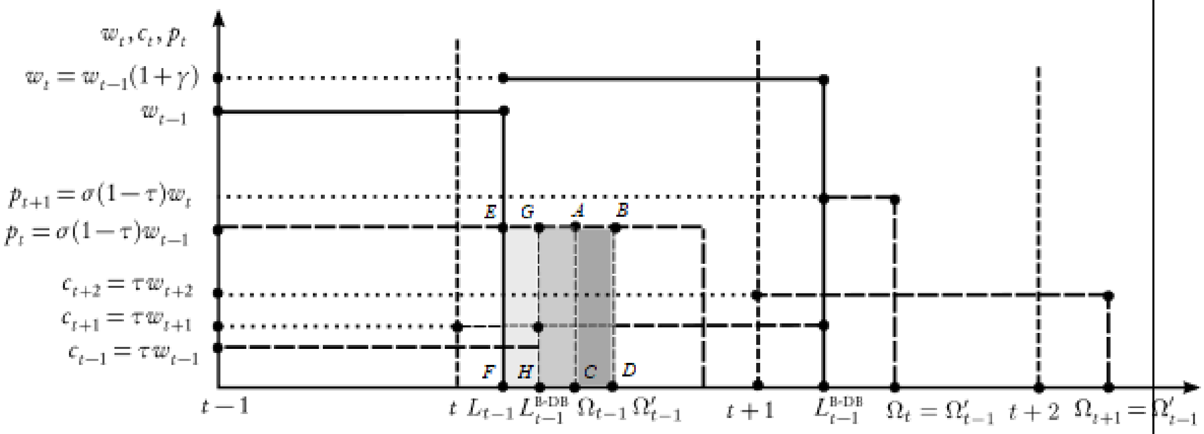

Figura 4. The endogenous replacement rate policy.

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