The Macroeconomic of Early Retirement*

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Abstract

Early retirement represents a persistent policy response to the appearance of a mass of redundant elderly workers, not entitled to a pension transfer. This distortionary policy reduces the incentive to accumulate human capital, and thus decreases economic growth. Why was it adopted? We suggest that alternative non-persistent policies, which do not introduce long-term distortions, but impose a larger cost on the current young generation of workers, were blocked by the political opposition of the high income workers, who did not plan to retire early, but sought to reduce the current tax burden, and of the middle income workers, who expect to retire early. What is the future of early retirement? We argue that, as the process of population aging reduces the performance of the PAYG system, the number of early retirees will diminish until, eventually, the political support in favor of this provision will disappear.

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1. Introduction

Since their adoption between the late 60s and the 70s, early retirement provisions have been so widely and persistently used to become a distinctive feature of the social security system in all industrialized countries. Early retirement is not innocuous, tough. Gruber and Wise (1999) and Blondal and Scarpetta (1998) have shown that this provision is, in fact, responsible for the dramatic decrease of the labor force participation in the last thirty years among middle aged and elderly workers. For instance, in the OECD countries, the average labor force participation of males aged between 55 and 64 has decreased from 84.2% in the 1960-66 period to 63.2% in 1986-90 period (see table 1). Ahituv and Zeira (2000) have complemented this view by suggesting that, in the presence of technologic progress, workers with lower human capital, or with more technology-specific human capital, are induced to take advantage of this provision, and to retire early. In a demographic context of aging population, this effect contributes to increase the dependency ratio, and therefore exacerbates the financial unbalance of the PAYG social security systems.

In a companion paper, Conde-Ruiz and Galasso (2000), we have suggested that the initial adoption of this provision constituted a political response to the appearance of a mass of redundant elderly workers, who were not entitled to a pension transfer. Early retirement awarded them a pension. However, to be politically sustainable – we also argued – early retirement had to be persistent[1], in order to attract the political support of a relevant fraction of the current young workers. Over these thirty years, this element of persistence has been guaranteed by the strong incentives that this generous provision has created for the low-ability young workers to retire early. Early retirement has therefore been able to create its own future political constituency.

In this paper, we focus on this element of persistency. First, we argue that the generous incentives to retire early induce low-ability workers to accumulate less human capital. In fact, evidence suggest that most early retirees have been low-educated workers (see table 2). This may reduce the growth rate of the economy and, because of its persistency, it may introduce long term distortions. Second, we examine whether alternative non-persistent policies could have been adopted as a political response to the appearance of a large mass of redundant elderly workers, rather than early retirement. We concentrate on one-time policies, which award a transfer to these redundant elderly, and are supported by a large share of voters. When we compare them to the early retirement provision, a clear trade-off emerges. One-time policies do not create long-term distortions, but impose a

[1] See also Coate and Morris (1999) on the importance of persistence for the political sustainability of a policy.

large cost on the current young generation of workers, whereas early retirement has negative, long-lasting effects on the growth of the economy, but induces a lower tax burden on the current young. In a pair-wise comparison, early retirement enjoys the support of high income workers, who do not plan to retire early, but sought to reduce the current tax burden, and of the middle income workers, who expect to retire early.

Are we then stuck with the early retirement? Will this provision last as long as the social security system exists? Not necessarily – we argue. Early retirement has the same effect on social security as the demographic process of population aging. Since the number of recipients from the system – the retirees – increases, and the number of contributors – the workers – decreases, the performance of the PAYG system is reduced. The entire social security system, and also the early retirement provision, becomes less attractive. The mass of early retirees diminishes, since even low-skilled workers choose to rely more heavily on their labor income, until the political support of the young in favor of this provision will eventually be lost.

We analyze these issues in an overlapping generations economy with human capital accumulation and growth. Young individuals are heterogeneous in their innate ability, which depends on their parents' human capital. They choose how much human capital to accumulate through an education technology, and when to retire. These decisions determine their labor income. The social security system consists of a PAYG scheme, with early retirement. Old age retirement is mandatory. Young workers pay a proportional labor income tax and the proceedings are divided among old age and early retirees. Workers who retire early are awarded an early retirement pension, while those who retire at mandatory age receive the full pension. In this setting, early retirement persistently distorts the human capital accumulation decision of the low-ability types, and thus reduces economic growth.

The alternative non-persistent policies are designed to provide the elderly workers initially affected by the shock with the same transfer as the early retirement pension, to have no effect on the elderly who are entitled to an old-age pension, and to be supported by a relevant fraction of the young. Specifically, we consider a one-time transfer to the elderly workers initially affected by the shock and to the young. In our setting, this policy induces only a temporary – albeit large – reduction in the economic growth, due to the decrease in the human capital accumulation of the every young agent.

The paper proceeds as follows: Section 2 introduces the economic model and the social security system, while section 3 characterizes an alternative policy response and compares it to the early retirement provision. Section 4 discusses the future of early retirement, and section 5 concludes. All proofs are in the appendix.

2. The Economic Model

We introduce a two sector overlapping generations model with growth. In every period, the economy is populated by young and old individuals. Population grows at a constant rate, $n > 0$. Young agents decide how much human capital to accumulate, and when to retire. Old agents do not work, retirement being mandatory. All consumption takes place in old age.

Each generation consists of a continuum of agents, who are heterogenous in their innate ability. An agent's innate ability is equal to the human capital level of her parents. At any time t, a young agent is characterized by an innate ability level h_{t-1}, which can be converted into her own level of human capital, h_t, through an education technology. This acquired level of human capital entirely determines her working ability, and constitutes her descendants' innate ability. At time $t = 0$, there exists an initial generation of young and old agents. Every initial old agent is characterized by a level of human capital, which also represents the innate ability of her young descendants. We assume that these initial levels of human capital (for the old) or innate abilities (for the young) are distributed according to a cumulative distribution function $F_0(.)$, which has mean μ_0, and is skewed, $F_0(\mu_0) > 1/2$. In all future periods, the distribution of innate abilities, $F_t(.)$, will depend on the process of human capital accumulation.

Young individuals decide how much human capital to accumulate. All agents have access to the same Cobb Douglas education technology, which transforms investment in education into human capital[2], according to the agent's innate ability. Thus, as in Glomm and Ravikumar (1992), the law of human capital accumulation is:

$$h_t(e_t, h_{t-1}) = \theta (e_t)^{\gamma} (h_{t-1})^{1-\gamma} \text{ with } 0 < \gamma < 1 \text{ and } \theta > 0 \tag{2.1}$$

where $h_t(e_t, h_{t-1})$ is the level of human capital that an innate ability type h_{t-1} young individual obtains at time t by investing e_t units of consumption in education, θ is the productivity of the human capital sector, and $1 - \gamma$ represents the relative importance of the innate ability in the accumulation of human capital.

Young agents also decide when to retire. They may retire at mandatory retirement age, in which case they work during the entire working period, or they may retire early. To be entitled to a pension transfer for the remaining period of her live, an agent needs to work at least until the minimum retirement age, $\Theta < 1$. The amount of the pension received depends on the length of her actual working period. Individuals who retire before the minimum retirement age receive no pensions; agents who retire early, i.e., between the minimum and the mandatory

[2]We interpret the investment in human capital as a learning process which takes place on and off the work place, rather then just as primary or secondary education. According to Becker (1975), the cost of this general training process has to be beared by the workers.

retirement age, obtain a share α of the full pension during the remaining of their youth and in their old age; whereas agents retiring at the mandatory retirement age receive the full pension in old age. As Conde-Ruiz and Galasso (2000), we call P_t the full pension awarded at time t to an old agent who has worked during the entire working period, and Γ_{t+1}^{t} the percentage of the full pension awarded at time $t+1$ to an old agent born at time t, then

$$\Gamma_{t+1}^{t}(\phi_t) = \Gamma_{t}^{t}(\phi_t) = \begin{cases} 0 & \text{if } \phi_t < \Theta \\ \alpha & \text{if } \Theta \leq \phi_t < 1 \\ 1 & \text{if } \phi_t = 1 \end{cases} \tag{2.2}$$

where subscripts indicate the calendar time and superscripts the period in which the agent was born, $\phi_t \in [0,1]$ represents the retirement age, Θ is the minimum retirement age to be eligible for a pension, and α is the proportion of the full pension paid to an early retiree.

A linear production function coverts the worker's human capital, weighted by the duration of the working period, ϕ, into the only consumption good:

$$y_t(e_t, \phi, h_{t-1}) = \phi h_t(e_t, h_{t-1}) \tag{2.3}$$

There exists a storage technology that transforms a unit of today's consumption into $1+r$ units of tomorrow's consumption: $y_{t+1} = (1+r)\,y_t$. All private intertemporal transfers of resources into the future are assumed to take place through this technology.

Young agents have to decide when to retire, ϕ, and the amount of resources to invest in human capital, e. Additionally, they pay a proportional tax on their labor income, τ, and save all their resources for old age consumption through the storage technology. Old agents take no relevant economic decisions; they simply consume all their wealth. The intertemporal budget constraint of an agent born at time t with innate ability $h_{t-1}$is thus:

$$c_{t+1}^{t} = \left(\phi_t h_t(e_t, h_{t-1})(1-\tau_t) - e_t + (1-\phi_t)\Gamma_t^t(\phi_t)P_t\right)(1+r) + \Gamma_{t+1}^t(\phi_t)P_{t+1} \tag{2.4}$$

where τ_t is the payroll tax rate which finances the pensions at time t, and P_t and P_{t+1} are respectively the pensions at time t and $t+1$.

The utility function is assumed to depend only on future consumption[3], $u\left(c_{t+1}^{t}\right)$ and the individual discount factor to be equal to the inverse of the real interest

[3] By disregarding current consumption, we abstract from the saving decisions and from the effect of social security of these decisions (see Feldstein (1974)). The introduction of the leisure in the utility function, as in Conde-Ruiz and Galasso (2000) complicates the algebra without adding any relevant feature.

factor, $\beta = 1/(1+r)$, so that the young decisions over the length of the working period, and the human capital accumulation, do not depend on the exogenous interest rate.

To summarize, agents decide their retirement age and their human capital accumulation in order to maximize $U\left(c_{t+1}^{t}\right)$, subject to the budget constraint at equation 2.4. The following lemma characterizes these economic decisions.

Lemma 2.1. *For a given tax rate τ_t, and given proportion α_t, α_{t+1} of the unitary pensions P_t and P_{t+1}, the economic decisions of the agents can be summarized as follows:*

$$\phi_t^*\left(h_{t-1}\right) = \begin{cases} \Theta \text{ if } h_{t-1} \leq h_{t-1}^R \\ 1 \text{ if } h_{t-1} > h_{t-1}^R \end{cases} \tag{2.5}$$

$$e_t^*\left(h_{t-1}\right) = \begin{cases} \left(\theta\Theta\gamma\left(1-\tau_t\right)\right)^{\frac{1}{1-\gamma}} h_{t-1} \text{ if } h_{t-1} \leq h_{t-1}^R \\ \left(\theta\gamma\left(1-\tau_t\right)\right)^{\frac{1}{1-\gamma}} h_{t-1} \text{ if } h_{t-1} > h_{t-1}^R \end{cases} \tag{2.6}$$

where

$$h_{t-1}^R = \frac{\left(1-\Theta\right)\alpha_t P_t - \frac{1-\alpha_{t+1}}{1+r} P_{t+1}}{\left(\theta\left(1-\tau_t\right)\gamma^\gamma\right)^{\frac{1}{1-\gamma}}\left(1-\gamma\right)\left(1-\Theta^{\frac{1}{1-\gamma}}\right)} \tag{2.7}$$

In words, h_{t-1}^R represents the innate ability level of an agent who is indifferent between retiring early or at the mandatory retirement age. Clearly, those with innate ability levels below the threshold, $h_{t-1} \leq h_{t-1}^R$, retire early, and the others at mandatory age (see eq. 2.5). This innate ability level, h_{t-1}^R, characterizes the human capital accumulation decisions as well (see eq. 2.6). Agents with innate ability h_{t-1} below the threshold h_{t-1}^R will accumulate less human capital than agents with more innate ability $h_{t-1} > h_{t-1}^R$. The intuition is straightforward. Early retirement shortens the period of time devoted to production, and thus decreases the return from investing in human capital; as the low ability types retire early, they will also accumulate less human capital. Notice that the threshold innate ability, h_{t-1}^R, and therefore the mass of early retirees, is endogenous. It depends positively on the generosity of the early retirement provision, α_t and α_{t+1}, and of today's pension P_t, and on the current tax burden, τ_t, and negatively on the generosity of the future pension's, P_{t+1} (see eq. 2.7).

2.1. The Evolution of the Human Capital Distribution

In the previous section, we assumed that the human capital of the initial generation of old at time $t = 0$ (and thus the innate abilities of their offsprings), is distributed according to a cumulative distribution function $F_0(.)$. In the following periods, the evolution of the human capital distribution will depend on the young agents' decisions of investment in education, as described at eq. 2.6, and on the education technology at eq. 2.1.

In particular, for a given initial innate ability level, h_{t-1}, it is easy to show that the corresponding human capital level is:

$$h_t\left(h_{t-1}\right)=\begin{cases}\left(\theta\Theta^{\gamma}\gamma^{\gamma}\left(1-\tau_t\right)^{\gamma}\right)^{\frac{1}{1-\gamma}}h_{t-1}=ah_{t-1} & \text{if } h_{t-1}\leq h_{t-1}^{R}\\ \left(\theta\gamma^{\gamma}\left(1-\tau_t\right)^{\gamma}\right)^{\frac{1}{1-\gamma}}h_{t-1}=bh_{t-1} & \text{if } h_{t-1}>h_{t-1}^{R}\end{cases} \tag{2.8}$$

where h_{t-1}^{R} is defined at eq. 2.7.

Therefore, since h_t is a linear piece-wise transformation of h_{t-1}, the evolution over time of the human capital distribution for every $t>0$ can be described as follows:

$$F_t\left(h_t\right)=\begin{cases}F_{t-1}\left(h_t/a\right) & \text{if} \quad h_t\leq ah_{t-1}^{R}\\ F_{t-1}\left(h_t/b\right) & \text{if} \quad h_t>bh_{t-1}^{R}\end{cases}$$

where a and b are defined at eq. 2.8. In this setting, the distribution of human capital, $F_0\left(.\right)$, varies along the process of human capital accumulation. The initial distribution is immediately split in two by the existence of an innate ability threshold, h_0^R, which separates the agents who retire early, and thus accumulate less human capital, from those who retire later, and invest more in human capital. Over time, the distribution of human capital becomes extremely polarized, since all the descendants of the early retirees accumulate less human capital, while the descendants of the high human capital agents continue to accumulate more human capital. This feature is quite extreme in our stylized framework – notice that at time t there are no agents with intermediate innate abilities, i.e., between ah_{t-1}^{R} and bh_{t-1}^{R}– because the binary choice between retiring early or at normal retirement age induces a binary decision on the human capital accumulation as well, see eq. 2.6.

2.2. The Social Security System

As Conde-Ruiz and Galasso (2000), we introduce a balanced budget pay as you go (PAYG) social security system with early retirement, which redistributes from the rich to the poor. This element of within cohort redistribution is crucial, because it induces low ability young to support the social security system[4] (see Tabellini (1990) and Conde-Ruiz and Galasso (1999)). Every worker pays a proportional tax on her labor income, and the proceedings are divided among old age and early retirees. The pension transfer may depend on the length of the working period of the recipient, but not on her labor income. Since the system is balanced every

[4] Evidence in favor of the existence of this within cohort redistribution can be found in Boskin et al. (1987) and Galasso (2000).

period, the sum of all pension transfers is equal the sum of all contributions. Thus, the full pension transfer which balances the budget constraint is equal to:

$$P_t = \frac{\overbrace{(1+n)\int \phi_t h_t dF_{t-1}(h_{t-1})}^{\text{Tax Base}}}{\underbrace{\int \Gamma_t^{t-1}\left(\phi_{t-1}\right) dF_{t-2}(h_{t-2})}_{\text{Old Age Retirees}} + \underbrace{(1+n)\int (1-\phi_t)\,\Gamma_t^t(\phi_t)\, dF_{t-1}(h_{t-1})}_{\text{Early Retirees}}}\tau_t. \quad (2.9)$$

By substituting in eq. 2.9 the economic decisions of the agents at Lemma 2.1, we obtain

$$P_t = \frac{\left[1-\left(1-\Theta^{\frac{1}{1-\gamma}}\right)L_F\left(F_{t-1}\left(h_{t-1}^R\right)\right)\right](1+n)\,\theta^{\frac{1}{1-\gamma}}\left((1-\tau_t)\gamma\right)^{\frac{\gamma}{1-\gamma}}\mu_{t-1}}{1-(1-\alpha_t)F_{t-2}(h_{t-2}^R)+(1+n)(1-\Theta)\alpha_t F_{t-1}(h_{t-1}^R)}\tau_t \quad (2.10)$$

where $\mu_{t-1} = \int_0^\infty h_{t-1} dF_{t-1}(h_{t-1})$ is the mean innate ability in the economy, $F_{t-1}\left(h_{t-1}^R\right)$ is the proportion of young who decides to retire early, and $L_F(F_{t-1}\left(h_{t-1}^R\right)) = \left(\int_0^{h_{t-1}^R} h_{t-1} dF(h_{t-1})\right)/\mu_{t-1}$ represents the proportion of total innate ability owned by the early retirees, at time t.

Thus, in every period, the social security system is completely characterized by the exogenous minimum retirement age, the payroll tax rate, the full pension, and the percentage of the full pension awarded to the early retirees, $(\Theta, \tau, P, \alpha)$. As Conde-Ruiz and Galasso (2000), we assume that early retirees are either awarded the full pension or no transfer at all, $\alpha \in \{0,1\}$. The next lemma shows an important implication of this assumption.

Lemma 2.2. *For a given $\tau_t = \overline{\tau}$ and $\alpha_t = 1\ \forall t$ the sequence of full pensions which balances the social security budget constraint has the following balance growth path*

$$\frac{P_{t+1}}{P_t} = \left[1-\left(1-\Theta^{\frac{1}{1-\gamma}}\right)L_F\left(F_t\left(h_t^R\right)\right)\right]\left(\theta\gamma^\gamma(1-\overline{\tau})^\gamma\right)^{\frac{1}{1-\gamma}}.$$

2.3. The growth rates of the economy

At steady state, for a constant sequence of social security tax rates $\overline{\tau}$, the balance growth rates of the economy, with the early retirement provision, $g^{ER}(\overline{\tau})$, and without it, $g^{NR}(\overline{\tau})$, are respectively,

$$g^{ER}(\overline{\tau}) = \left[1-\left(1-\Theta^{\frac{1}{1-\gamma}}\right)L_F\left(F\left(h^R\right)\right)\right]\left(\theta\gamma^\gamma(1-\overline{\tau})^\gamma\right)^{\frac{1}{1-\gamma}} \quad (2.11)$$

$$g^{NR}(\overline{\tau}) = \left(\theta\gamma^\gamma(1-\overline{\tau})^\gamma\right)^{\frac{1}{1-\gamma}} \quad (2.12)$$

Clearly, $g^{ER}(\overline{\tau}) \leq g^{NR}(\overline{\tau})$, since early retirement reduces the accumulation of human capital by the early retirees. In order to have a positive growth rate in the two scenarios, we need to impose that the investment in human capital is sufficiently productive:

$$\theta > \left(1 - \left(1 - \Theta^{\frac{1}{1-\gamma}}\right) L_F\left(F_t\left(h_t^R\right)\right)\right)^{-(1-\gamma)} \left(\left(1-\overline{\tau}\right)\gamma\right)^{-\gamma} \quad \forall t.$$

3. Early Retirement and an Alternative Policy Response

In Conde-Ruiz and Galasso (2000), we suggested that the initial introduction of the early retirement provision represents the political response to a negative shock: the appearance of a large mass of redundant elderly workers with an incomplete working history, who were not entitled to an old age pension. We argue that the adoption of early retirement came to their rescue, by awarding them a pension. The long run political sustainability of the system, however, relies on the existence of a large number of (mainly) low-ability workers, who, after the early retirement institution has been introduced, and thanks to the incentives it produces, decide to benefit from this provision, and thus to retire early. The former feature is crucial, since it introduces a strong element of persistency in this policy response, and allows the early retirement provision to create its own future political constituency.

We consider an economy in which there initially exists a social security system. At time T, a negative shock takes place, which gives rise to the appearance of a large mass of redundant elderly workers, who are not entitled to an old age pension. As a political response, an early retirement provision is introduced. In particular, at time T, this social security system with early retirement is characterized by a tax rate, $\overline{\tau}$, an exogenous retirement age, Θ, a rule that awards a generous (full) pension to the early retirees, $\alpha = 1$, and a pension transfer, $P_T(\overline{\tau}, 1)$, which is defined at eq. 2.10 for $\tau = \overline{\tau}$ and $\alpha = 1$. The corresponding indirect utility function at time T for a young individual with innate ability h_{T-1} who retires early is:

$$v^{ER}(\overline{\tau}, 1, h_{T-1}) = \left(\theta\gamma^{\gamma}\Theta\left(1-\overline{\tau}\right)\right)^{\frac{1}{1-\gamma}} (1-\gamma) h_T + (1-\Theta) P_T(\overline{\tau}, 1) + \frac{P_{T+1}(\overline{\tau}, 1)}{1+r} \tag{3.1}$$

whereas if she retires at mandatory age, her indirect utility function is:

$$v^{NR}(\overline{\tau}, 1, h_{T-1}) = \left(\theta\gamma^{\gamma}\left(1-\overline{\tau}\right)\right)^{\frac{1}{1-\gamma}} (1-\gamma) h_T + \frac{P_{T+1}(\overline{\tau}, 1)}{1+r}. \tag{3.2}$$

In our economy with growth, we can complement the analysis in Conde-Ruiz and Galasso (2000), and evaluate the negative, long term effects on the growth rate of the economy of this persistent political response. In fact, the institution of early retirement decreases the capital accumulation by the successive generations of early retirees, and thus reduces the rate of growth of the economy. In particular, let $\epsilon \in [0,1]$ be the initial mass of old individuals with incomplete working history at time T, who had not matured any right to a pension transfer. And let h^R_{T-1} be the innate ability type of the individual who is indifferent between retiring early or at mandatory age, when an early retirement provision with tax rate $\overline{\tau}$ is introduced at time T. In this case, the growth rate of the economy is defined at eq. 2.11, and can easily be compared with the growth rate in absence of early retirement, at eq. 2.12.

The aim of this section is to examine an alternative political response to the appearance of a mass of redundant elderly workers, which is not persistent, and therefore does not introduce long run distortions in the economy, and to compare it to the early retirement provision. We will focus on one-time policies, which would be supported by a large number of voters, and may thus represent a political economic equilibrium of a majority voting game. Notice that most one-time policies do not constitute a political equilibrium. For example, a one-time award of a pension to the elderly workers initially affected by the shock, which would not discourage the human capital accumulation by the future generations, is not a political equilibrium, since it would be opposed by all the young.

3.1. An Alternative Policy Response

Our strategy is to design a *non-persistent* policy response that (i) provides the elderly workers initially affected by the shock with a one-time transfer equal to the early retirement pension, (ii) has no impact on the elderly who are entitled to the an old-age pension, and (iii) succeeds in making a sufficiently large number of young agents better off. Specifically, this alternative *non-persistent* policy consists of a redistributive program, which provides a lump-sum transfer, A, to the young and to the initial mass, ϵ, of elderly who are not entitled to a pension, and is financed by a proportional tax s on the labor income. In order to compare this alternative policy to the early retirement provision, we require (i) the transfer under this alternative policy to be equal to the early retirement pension (*policy constraint* 1) and (ii) the pension awarded to the old with complete working history to be unaffected by the policy in place (*policy constraint* 2). Thus, these constraints guarantee that all the elderly receive an equal treatment under early retirement and under the alternative policy.

Formally, the alternative policy at time T consists of a quadruple (τ, s, P, A), where τ and s are the tax rates on the labor income, which finance respectively the old age pension, P, and the one-time transfer, A. The old age pension transfer is provided to the mass $1-\epsilon$ of elderly with complete working history, and is equal to

$$P_T(\tau, 0, s) = \frac{(1+n)\left(\theta(1-\tau)^\gamma (1-s)^\gamma \gamma^\gamma\right)^{\frac{1}{1-\gamma}} \mu_{T-1}}{1-\epsilon}\tau. \tag{3.3}$$

The one-time transfer goes to the young and to the mass, ϵ, of elderly workers who are not entitled to an old age pension, and is equal to

$$A = \frac{(1+n)\left(\theta(1-\tau)^\gamma (1-s)^\gamma \gamma^\gamma\right)^{\frac{1}{1-\gamma}} \mu_{T-1}}{1+n+\epsilon}s. \tag{3.4}$$

The two policy constraints guarantee that, regardless of their working history, all the elderly at time T are indifferent between the two policies: They can be summarized as follows:

$$A = P_T(\overline{\tau}, 1) = P_T(\tau, 0, s) \tag{3.5}$$

Under this alternative policy, at time T, a young agent with innate ability h_{T-1} determines her investment in human capital, e_T, in order to maximize her utility function, $u\left(c_{T+1}^T\right)$, subject to the following budget constraint

$$c_{T+1}^T = \left(\phi_T h_T(e_T, h_{T-1})(1-\tau_T)(1-s_T) - e_t + A\right)(1+r) + P_{T+1}(\tau_{T+1}, 0, 0). \tag{3.6}$$

Notice that $P_{T+1}(\tau_{T+1}, 0, 0) = (1+n)\left(\theta(1-\tau_{T+1})^\gamma \gamma^\gamma\right)^{\frac{1}{1-\gamma}} \mu_T \tau_{T+1}$ is the old age pension received at $T+1$ in absence of the alternative policy. In fact, recall that this alternative policy represents a one-time response, and thus in all future periods, $t > T$, there will be no transfer A, but only a social security system, $(\tau, 0, P, 0)$.

The alternative policy has a negative effect on the human capital accumulation at time T, but no additional impacts on future periods' decisions. Thus, the growth rate of the economy at time T is

$$g^A(\tau, s) = \left(\theta(1-\tau)^\gamma (1-s)^\gamma \gamma^\gamma\right)^{\frac{1}{1-\gamma}} \tag{3.7}$$

whereas it is equal to $g^{NR}(\tau_l)$ – see eq. 2.12 – for all future periods $l > T$.

Finally, it is easy to show that, under this alternative policy, the indirect utility function at time T for a young individual with innate ability h_{T-1} is

$$v^A(\tau, s, h_{T-1}) = \left(\theta\gamma^\gamma \Theta(1-\tau)(1-s)\right)^{\frac{1}{1-\gamma}}(1-\gamma)h_T + A + \frac{P_{T+1}(\tau_{T+1}, 0, 0)}{1+r}. \tag{3.8}$$

3.2. Comparing Policies

Through the policy constraints at eq. 3.5, we have devised a policy response that awards to the elderly – both to those with an entitlement to an old age pension and to those without it – the same transfer as under the early retirement provision, and thus makes them indifferent between these two policies. The result of a pairwise comparison between these two policies thus depends exclusively on the preferences of the young.

Which policy would the young support? Would they prefer a persistent early retirement provision or a one-time redistributive policy? To simplify the analysis, we consider that the two policies pay the same old age pension at $T+1$, i.e., the period after the shock has taken place: $P_{T+1}(\tau_{T+1}, 0, 0) = P_{T+1}(\overline{\tau}, 1)$. Future pensions are relevant in current young voters' decisions. We assume that the two alternative policies do not differ in their old age pension transfer, although they may differ in the associate tax rates[5].

We examine separately the preferences of those young agent who, in the presence of an early retirement provision, would retire at mandatory age and of those who would retire early. The next proposition suggests that, if the alternative policy imposes a larger tax burden than the early retirement provision, there will exist young agents who support the adoption of early retirement, although they do not expect to retire early. For these relatively rich agents, the alternative policy represents a more costly response to the appearance of elderly workers with incomplete working history than early retirement.

Proposition 3.1. *At time T, if $(1-\overline{\tau}) > (1-s)(1-\tau)$, there exists an innate ability type $\widetilde{h}$, such that all young agents with higher innate ability types, $h > \widetilde{h}$, who would choose not to retire early, $h > h^R_{T-1}$, prefer the adoption of the early retirement provision $(\Theta, \overline{\tau}, P_T(\overline{\tau}, 1), \alpha = 1)$ to the alternative policy $(\tau, s, P_T(\tau, 0, s), A)$, where*

$$\widetilde{h} = \frac{1+n}{1+n+\epsilon} \frac{((1-s)(1-\tau))^{\frac{1}{1-\gamma}} s}{(1-\gamma)\left((1-\overline{\tau})^{\frac{1}{1-\gamma}} - ((1-s)(1-\tau))^{\frac{1}{1-\gamma}}\right)} \mu_{T-1}$$

Low innate ability young agents benefit from both systems. They retire early in the presence of this provision, and are net recipients from the alternative redistributive policy. The next proposition shows that, if the alternative policy imposes a larger tax burden than the early retirement provision, where the latter

[5] Notice that three elements are crucial in comparing $P_{T+1}(\tau_{T+1}, 0, 0)$ and $P_{T+1}(\overline{\tau}, 1)$: (i) the number of pensions recipients, which is higher under early retirement, (ii) the average income in the economy, which depends on the growth rate differential between the two policies at T, and (iii) the tax rates τ_{T+1} and $\overline{\tau}$.

tax burden is evaluated over their reduced working period, there will exist young agents with intermediate innate ability, who support early retirement. Lower innate ability types will sustain the alternative policy. The intuition runs as follows. Among the potential early retirees, the former individuals are relatively rich, and thus care about the tax burden that the two policies impose on their labor income. The latter agents are poorer. They prefer the alternative policy, which redistributes in their favor during the entire working period, rather than the early retirement, which only pays a transfer over a reduced time horizon: from early to mandatory retirement age.

Proposition 3.2. *At time T, if $\Theta\left(1-\overline{\tau}\right)>\left(1-s\right)\left(1-\tau\right)$, there exists an innate ability type $\widehat{h}$, such that all young agents with higher innate ability types, $h>\widehat{h}$, who would retire early if the provision is available, $h<h_{T-1}^{R}$, prefer the adoption of the early retirement provision $\left(\Theta,\overline{\tau},P_{T}\left(\overline{\tau},1\right),\alpha=1\right)$ to the alternative policy $\left(\tau,s,P_{T}\left(\tau,0,s\right),A\right)$, where*

$$\widehat{h}=\frac{\Theta\left(1+n\right)\left[1-\left(1-\Theta^{\frac{1}{1-\gamma}}\right)L_{F}\left(F_{T-1}\left(h_{T-1}^{R}\right)\right)\right]\left(1-\overline{\tau}\right)^{\frac{\gamma}{1-\gamma}}\tau}{\left(1+\left(1+n\right)\left(1-\Theta\right)F_{T-1}\left(h_{T-1}^{R}\right)\right)\left(1-\gamma\right)\left(\left(\Theta\left(1-\overline{\tau}\right)\right)^{\frac{1}{1-\gamma}}-\left(\left(1-s\right)\left(1-\tau\right)\right)^{\frac{1}{1-\gamma}}\right)}\mu_{T-1}$$

Thus, in a pairwise comparison, the adoption of early retirement is preferred to the alternative non-persistent policy if there exists a sufficiently large mass of young agents with high innate ability, among those retiring at mandatory age, $h>\widetilde{h}$, and with intermediate innate ability, among those who retire early, $\widehat{h}<h<h_{T-1}^{R}$. Notice that this condition depends on the rate of growth of the economy under the two policies. In fact, the main difference between these polices is that while the early retirement provision reduces the incentives to accumulate human capital for low ability workers in all current and future periods, the alternative policy reduces the incentives to accumulate human capital for all workers, but only during the current period. Equations 2.11, 2.12, and 3.7, and the next proposition characterize the different growth rates.

Proposition 3.3. *$g^{A}\left(\tau,s\right)<g^{ER}\left(\overline{\tau}\right)$ if and only if $\left(\left(1-\tau\right)\left(1-s\right)\right)^{\frac{\gamma}{1-\gamma}}<\left(1-\overline{\tau}\right)^{\frac{\gamma}{1-\gamma}}(1-(1-\Theta^{\frac{1}{1-\gamma}})L_{F}\left(F_{T-1}\left(h_{T-1}^{R}\right)\right))$.*

Taken together, these three propositions suggest that, if the growth rate of the economy at time T is higher under early retirement than under the alternative policy, relatively rich agents may prefer to respond to the appearance of elderly workers with incomplete working history by instituting the early retirement provision rather than with the alternative policy, although the latter policy may induce lower long run distortion in the economy. This intuition is very powerful. Early retirement provisions require less initial resources, and therefore are preferred by relatively high-income types. On the contrary, the alternative policy is less distortionary in the long-run, because it causes only a one-time distortion of the rate of growth of the economy, but it concentrates the cost of financing on one generation only – today's young.

4. The Future of Early Retirement

One of the key features of the political sustainability of early retirement is its policy persistence, achieved by providing strong incentives to the current young workers with low innate ability to retire early, and thus to become fervent supporters of this provision. This scenario has been common to virtually all industrialized countries in the last thirty years. After its initial adoption, early retirement has been widely used, thereby generating a dramatic decrease in the labor force participation of the low skilled elderly workers. Does this mean that the early retirement provision has created its own future political constituency, and thus will never be dismantled? Will early retirement survive as long as the PAYG systems exist? Not necessarily – we will argue.

To see this, consider another common phenomenon of the last few decades: the demographic process of population aging, due to the combined effect of a rise in longevity and a decrease in the fertility rate. This demographic process reduces the performance of a PAYG social security system, since the recipients from the system – the retirees – become more numerous, while the number of contributors – the workers – is reduced[6]. To foster the importance of this phenomenon, Boldrin and Rustichini (2000) have shown that, in the context of a decreasing population growth rate, a majority of voters may eventually choose to dismantle the existing PAYG social security system.

Early retirement goes in the same direction as population aging. It contributes to reduce the performance of the system by further increasing the dependency ratio. The next proposition suggests that this provision may be adopted and later – when the population has become sufficiently old – it may be eliminated, although the PAYG social security system remains still in place.

Proposition 4.1. *If the population growth rate, n, decreases over time, the early retirement provision will eventually be eliminated.*

The message of this proposition is that as the population ages, the early retirement provision becomes less attractive, and eventually will not be used. Notice,

[6] The aging of the population may also increase the political representation of the elderly. See Galasso (1999) for an analysis of the combined effect.

in fact, that, for a given tax rate, $\overline{\tau}$, a decrease in the population growth rate reduces all pension transfers. Young individuals will rely more heavily on their labor income, and thus the mass of early retirees will diminish. This element is crucial. In fact, in Conde-Ruiz and Galasso (2000), we showed that the young voter who is indifferent between supporting early retirement or not is an early retiree. Thus, since the mass of early retirees decreases, the decisive (or median) voter will eventually become an agent who prefers to retire at mandatory age. At this point, she will choose to eliminate early retirement.

If the early retirement provision is expected to be eliminated, why is it supported in the period previous to its elimination, and thus in all previous periods? Typically, in these intergenerational transfer schemes, the current sustainability of the system is based on the expectation of its future sustainability[7]. To overcome this problem in a deterministic environment with population aging, we consider that, if the provision is in place at time t, and is then eliminated at $t+1$, those agents who retired early at time t are entitled to an old age pension at $t+1$. This feature makes early retirement extremely convenient in the period that precedes its elimination. In fact, in their old age these early retirees are awarded a larger transfer than the early retirement pension. As a result, we argue that there is an increase in the mass of early retirees immediately before the provision is dismantled.

5. Conclusions

In Conde-Ruiz and Galasso (2000), we suggested that the adoption of the early retirement provision, which in most industrialized countries took place between the late 60s and the 70s, has represented a political response to the appearance of a large group of redundant elderly workers with incomplete working history, who were not entitled to a pension transfer. This was not a one-time policy. Since then, in fact, this provision has become a common early pathway out of the labor market for several generations of low-ability workers.

In this paper, we argue that, because of its persistency, the early retirement provision introduces a long run distortion in the economy. In fact, during the three decades from its initial adoption, early retirement has reduced the incentives to accumulate human capital for the low-ability workers, and has thereby decreased the economic growth.

Was this persistent, distortionary policy the only possible response to the appearance of redundant workers with no entitlement to a pension? Certainly not. A wide variety of non-persistent policies were available to transfer resources

[7] Boldrin and Rustichini (2000), however, show that in a stochastic environment, current sustainability of the system does not require future one.

to the elderly workers initially hit by the negative shock. However, these one-time policies did not typically enjoy the support of a large share of voters, and thus did not constitute a political equilibrium.

To see this, we have devised a non-persistence redistributive system that (i) provides the initial redundant elderly workers with the same transfer as the early retirement pension, (ii) has no impact on the elderly entitled to an old-age pension, and (iii) is supported by a relevant fraction of the young voters. A clear trade-off emerges from comparing this policy to the early retirement provision. Unlike early retirement, this one-time policy does not reduce the long-term economic growth, but imposes a larger tax burden on the current young generation of workers. In a pair-wise comparison, early retirement wins the support of the high income workers, who do not plan to retire early, but prefer this provision because of its lower current tax burden, and of the middle income workers, who expect to retire early.

What is the future of early retirement? Does its persistency imply that this provision will last as long as the social security system? Not necessarily – we argue. In fact, the current demographic dynamics of population aging is reducing the performance of the PAYG system, by increasing the dependency ratio. If this process continues, early retirement – as well as the entire social security scheme – will becomes less attractive. In this case, the mass of early retirees will diminish until early retirement will eventually lose the necessary political support.

Table 1
Males Aged 55-64 Labor Force Participation

	$1960-66$	1996
Canada	81.9	59.3
France	78.7	42.3
Germany	$77.8^{(1)}$	52.7
Italy	70.4	$55.8^{(2)}$
Japan	87.8	84.9
Netherlands	87.7	43.1
Spain	91.9	56.3
Sweden	87.5	72.2
UK	91.3	62.9
US	83.6	67.0
OECD Avg	84.2	$63.2^{(3)}$
Non OECD Avg	84.5	$70.3^{(3)}$

Data Source: Word Bank (1994), OECD Labor Force Statistics (1996)

Notes: [1] Year 1971, [2] Data for 50-64 age group, [3] Data for 1986-90

Table 2:

Share of Retirees among Male Workers aged 55-64 by Level of Education in 1995

	No further Education	Vocational Education	Third Level Education
Belgium	53.4%	57.6%	36.9%
France	51.1%	47.6%	28.9%
Italy	44.7%	47.4%	22.2%
Netherlands	56.8%	48.2%	40.8%
UK	24.1%	20.6%	21.4%
Germany	29.2%	28.5%	21.6%
Spain	24.9%	26.9%	21.6%

Source: Blöndal and Scarpetta (1998)

5.1. Technical Appendix

5.1.1. Proof of Lemma 2.1

Since the function $\Gamma_t^t(\phi_t) = \Gamma_{t+1}^t(\phi_t)$ is discrete, individuals will either retire at the minimum retirement age, $\phi_t = \Theta$, or at mandatory age, $\phi_t = 1$. If a type h_{t-1} young individual decides to work during the entire working period, $\phi_t(h_{t-1}) = 1$, her human capital accumulation decision will be $e_t(x) = (\theta\gamma(1-\tau_t))^{\frac{1}{1-\gamma}} h_{t-1}$, and the corresponding utility level:

$$v_t^{NR}(\tau_t, P_{t+1}, h_{t-1}) = (\phi_t h_t(e_t, h_{t-1})(1-\tau_t) - e_t) + \Gamma_{t+1}^t(1)\frac{P_{t+1}}{1+r}$$

where $\Gamma_{t+1}^t(1) = 1$.

Whereas if she decides to retire at the minimum retirement age, $\phi_t(h_{t-1}) = \Theta$, her human capital level will be $e_t(h_{t-1}) = (\Theta\gamma(1-\tau_t))^{\frac{1}{1-\gamma}} h_{t-1}$, and the corresponding utility:

$$\begin{aligned} v_t^{WR}(\tau_t, P_{t+1}, P_t, \alpha_t, \alpha_{t+1}, h_{t-1}) &= (\theta\Theta(1-\tau_t)\gamma^\gamma)^{\frac{1}{1-\gamma}}(1-\gamma)h_{t-1} + \\ &\quad (1-\Theta)\Gamma_t^t(\Theta)P_t + \frac{\Gamma_{t+1}^t(\Theta)P_{t+1}}{1+r} \end{aligned}$$

where $\Gamma_t^t(\Theta) = \alpha_t$ and $\Gamma_{t+1}^t(\Theta) = \alpha_{t+1}$.

Therefore, the indirect utility function is

$$v_t(\tau_t, P_{t+1}, P_t, \alpha_t, \alpha_{t+1}, h_{t-1}) = \max\left\{v_t^{NR}, v_t^{WR}\right\}$$

Since $v_t^{NR}(\tau_t, P_{t+1}, h_{t-1}) - v_t^{WR}(\tau_t, P_{t+1}, P_t, \alpha_t, \alpha_{t+1}, h_{t-1})$ is monotonically increasing in the ability level, h_{t-1}, for given parameters of the social security system, $(\tau_t, P_t, P_{t+1}, \alpha_t, \alpha_{t+1})$, the ability level which make an agent indifferent between retire at mandatory age or earlier is:

$$h_{t-1}^R = \frac{(1-\Theta)\alpha_t P_t - \frac{1-\alpha_{t+1}}{1+r}P_{t+1}}{(\theta(1-\tau_t)\gamma^\gamma)^{\frac{1}{1-\gamma}}(1-\gamma)\left(1-\Theta^{\frac{1}{1-\gamma}}\right)}.$$

Thus, young agents with ability type $h_{t-1} \leq h_{t-1}^R$ will retire early, at $\phi_t(h_{t-1}) = \Theta$, whereas agents with ability type $h_{t-1} \leq h_{t-1}^R$will work for the entire working period[8], $\phi_t(h_{t-1}) = 1$, which proves the lemma. ■

[8] We assume that individuals who are indifferent between early retirement and retirement at mandatory age will retire early.

5.1.2. Proof of Lemma 2.2

If $\tau_t = \overline{\tau}$ and $\alpha_t = 1$ $\forall t$, from equations 2.10 and 2.7, evaluated at time t and $t+1$, we have $h_t^R = \frac{P_{t+1}}{P_t} h_{t-1}^R$. Thus, $F_t\left(h_t^R\right) = F_{t-1}\left(h_t^R / \frac{P_{t+1}}{P_t}\right) = F_{t-1}\left(h_{t-1}^R\right)$, $L_F\left(F_{t-t}\left(h_{t-1}^R\right)\right) = L_F\left(F_t\left(h_t^R\right)\right) = L_F\left(F_0\left(h_0^R\right)\right)$ and $P_{t+1} = \frac{\mu_t}{\mu_{t-1}} P_t$, where $\mu_t = \int F_t\left(h_t\right) dh_t$, $\mu_{t-1} = \int F_{t-1}\left(h_{t-1}\right) dh_{t-1}$ and $h_t\left(h_{t-1}\right)$ is defined at eq. 2.8. Therefore,

$$\mu_t = \left[1 - \left(1 - \Theta^{\frac{1}{1-\gamma}}\right) L_F\left(F_{t-1}\left(h_{t-1}^R\right)\right)\right] \theta^{\frac{1}{1-\gamma}} \left(\left(1-\overline{\tau}\right)\gamma\right)^{\frac{\gamma}{1-\gamma}} \mu_{t-1}$$

which implies

$$P_{t+1}/P_t = \left[1 - \left(1 - \Theta^{\frac{1}{1-\gamma}}\right) L_F\left(F_t\left(h_t^R\right)\right)\right] \theta^{\frac{1}{1-\gamma}} \left(\left(1-\overline{\tau}\right)\gamma\right)^{\frac{\gamma}{1-\gamma}}. \blacksquare$$

5.1.3. Proof of Proposition 3.1

A necessary condition for an individual with innate ability h_{T-1}, who do not retire early, $h_{T-1} > h_{T-1}^R$, to prefer the early retirement provisions to the alternative policy A is that $v^{NR}\left(\overline{\tau}, 1, h_{T-1}\right) \geq v^A\left(\tau, s, h_{T-1}\right)$. Using equations 3.2, 3.8, and 3.4, and since $P_{T+1}\left(\tau, 0, 0\right) = P_{T+1}\left(\overline{\tau}, 1\right)$, we have

$$\widetilde{h} = \frac{\left(\left(1-s\right)\left(1-\tau\right)\right)^{\frac{1}{1-\gamma}} s\mu_{T-1}}{\left(1-\gamma\right)\left(\left(1-\overline{\tau}\right)^{\frac{1}{1-\gamma}} - \left(\left(1-s\right)\left(1-\tau\right)\right)^{\frac{1}{1-\gamma}}\right)} \frac{1+n}{1+n+\epsilon}$$

where the numerator is always positive, and the denominator is positive if $\left(1-\overline{\tau}\right) > \left(1-s\right)\left(1-\tau\right)$. $\blacksquare$

5.1.4. Proof of Proposition 3.2

A necessary condition for an individual with innate ability h_{T-1}, who retires early, $h_{T-1} < h_{T-1}^R$, to prefer the early retirement provisions to the alternative policy A is that $v^{ER}\left(\overline{\tau}, 1, h_{T-1}\right) \geq v^A\left(\tau, s, h_{T-1}\right)$. Using equations 3.1, 3.8, and 2.10, and since $P_{T+1}\left(\tau, 0, 0\right) = P_{T+1}\left(\overline{\tau}, 1\right)$, we have

$$\widehat{h} = \frac{\Theta\left(1+n\right)\left[1 - \left(1 - \Theta^{\frac{1}{1-\gamma}}\right) L_F\left(F_{T-1}\left(h_{T-1}^R\right)\right)\right]\left(1-\overline{\tau}\right)^{\frac{\gamma}{1-\gamma}} \mu_{T-1}\tau}{\left(1 + \left(1+n\right)\left(1-\Theta\right) F_{T-1}\left(h_{T-1}^R\right)\right)\left(1-\gamma\right)\left(\left(\Theta\left(1-\overline{\tau}\right)\right)^{\frac{1}{1-\gamma}} - \left(\left(1-s\right)\left(1-\tau\right)\right)^{\frac{1}{1-\gamma}}\right)}$$

where the numerator is always positive, and the denominator is positive if $\Theta\left(1-\overline{\tau}\right) > \left(1-s\right)\left(1-\tau\right)$. $\blacksquare$

5.1.5. Proof of Proposition 4.1

We prove this proposition in the simplified economic environment of Conde-Ruiz and Galasso (2000), in which there is no human capital accumulation, the working ability is equal the innate ability, and its distribution is constant over time. It is thus useful to introduce some \notation: $P_t(\overline{\tau}, 1)$ and $P_t(\overline{\tau}, 0)$ are the pension transfers at time t, respectively in presence and in absence of early retirement, with $P_{t+1}(\overline{\tau}, 0) > P_{t+1}(\overline{\tau}, 1)$. And $h\Theta(1-\overline{\tau})$ or $h(1-\overline{\tau})$ are respectively the labor income of a type h agent when she retires early or at mandatory age. We need to show that (i) as the population growth rate decreases, the existing early retirement provision is eliminated; and (ii) provided that it will eventually be eliminated, early retirement is initially introduced and sustained.

(i) From Conde-Ruiz and Galasso (2000), we know that early retirement, defined by the quadruple $(\Theta, \overline{\tau}, P_T(\overline{\tau}, 1), \alpha = 1)$, exists at time $t > T$, if $h_t^{MV} < \overline{h}_t$, where h_t^{MV} is the median voter over the early retirement provision at time t and

$$\overline{h}_t = \frac{(1-\Theta) P_t(\overline{\tau}, 1) - [P_{t+1}(\overline{\tau}, 0) - P_{t+1}(\overline{\tau}, 1)] / (1+r)}{(1-\Theta)(1-\overline{\tau})}$$

is the threshold innate ability level of a young agent, who is indifferent between voting in favor or against the early retirement provision. Notice that, if the provision exists, this individual is an early retiree, since

$$\overline{h}_t = h_t^R - \frac{P_{t+1}(\overline{\tau}, 0) - P_{t+1}(\overline{\tau}, 1)}{(1-\Theta)(1-\overline{\tau})(1+r)} < h_t^R = \frac{P_t(\overline{\tau}, 1)}{(1-\overline{\tau})}$$

where h_t^R is the ability type of the individual, who is indifferent between retiring early or at mandatory retirement age, at t. By total differentiating the previous expression, we obtain that

$$\frac{dh_t^R}{dn} = \frac{\overbrace{\partial P_t(\overline{\tau}, 1) / \partial n}^{>0}}{1 - \Theta - \underbrace{\partial P_t(\overline{\tau}, 1) / \partial h_t^R}_{<0}} > 0,$$

that is, as the population ages, the mass of early retirees decreases.

Suppose that at some $t' > T$, $h_{t'}^{MV} < \overline{h}_{t'} < h_{t'}^R$, and the early retirement provision is in place. As n decreases, so does h_t^R, until eventually at some time $t'' > t'$ we have that $h_{t''}^R < h_{t''}^{MV}$, which in turn implies that $\overline{h}_{t''} < h_{t''}^{MV}$, since $\overline{h}_t < h_t^R \; \forall t$. Therefore, the median voter at t'' will eliminate the early retirement provision.

(ii) If the provision is eliminated at t'', will the median voter at $t''-1$ be willing to support early retirement? The answer depends crucially on the treatment that early retirees at $t'' - 1$ obtain in their old age, at t''. We consider that the agents who retired early at time $t'' - 1$ are entitled to an old age pension at t''. Since the early retirement provision is eliminated in t'', this pension is equal to $P_{t''}(\overline{\tau}, 0)$, which is greater than $P_{t''}(\overline{\tau}, 1)$, and thus, ceteris paribus, makes early retirement in $t'' - 1$ even more convenient. For a constant n, we have that $\overline{h}_{t''} < \overline{h}_{t''-1} = \frac{P_{t''}(\overline{\tau},0)}{(1-\overline{\tau})}$, and $h_t^R < h_{t''-1}^R = \frac{P_{t''}(\overline{\tau},0)}{(1-\overline{\tau})}$ $\forall t < t'' - 1$. Therefore, not only the median voter at $t'' - 1$ will be willing to support early retirement, but there will be an increase of mass of early retirees. ■

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