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# Postponing the Legal Retirement Age

Juan A. Lacomba*† and Francisco M. Lagos‡

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**Abstract**

This paper analyzes the reform of the pensionable age as an answer to the future financing problems of public pension systems. We use a two-staged model where, firstly, the government decides the redistribution level of the pension system, and, secondly, individuals face a voting process on the legal retirement age. Our results suggest that an increase in the redistributive character of the system could lead to a larger social consensus to postpone the legal retirement age. Surprisingly, it could be the case that the richest people would support more redistribution if that implies to postpone the pensionable age.

**Keywords**: Legal retirement age, pension benefits, redistribution level

**JEL code**: D72, D91, H55

*Department of Economics, University of Granada and Games. E-mail address: jlacomba@ugr.es

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‡Department of Economics, University of Granada and Games. Campus la Cartuja s/n. 18011 Granada. Spain. Tel.: 0034-958249605; Fax: 0034-958249995. E-mail address: fmlagos@ugr.es

## 1. Introduction

Reforms of Social Security systems is now one of the main issues of economic policy agenda of most of industrialized countries. It is widely considered that, unless there are serious changes, the rise in the number of retirees relative to workers will threat the viability of pay-as-you-go public pension systems in the long-run. With the aim of eliminating these future financial problems, the central reforms that are being proposed are raising taxes, cutting pension benefits and/or raising the age of retirement, see Blondal and Scarpetta (1998) or Gruber and Wise (1997).

In order to achieve this latter reform, the main economic policy measures are either to allow a greater flexibility in Social Security's retirement rules (e.g. Germany, Italy or Sweden), to reinforce the link between life-time contributions and pension benefits or to postpone the pensionable age. In point of fact, this last measure is one of the policy conclusions of *Maintaining Prosperity in an Ageing Society*, OECD (1998): "...a direct way to encourage people to work longer would be to raise the pensionable age".

However, according to recent surveys, most of workers declare that they are happy with the current retirement age (see Cremer and Pestieau, 2003), which

suggests that reforms on the retirement age are becoming a delicate matter for governments. For this reason, this paper analyzes this issue: the reform of the pensionable age.

Social Security systems are usually defined by three variables, its size, its redistributive character and its pensionable or legal retirement age. As mentioned above, aiming at delaying the retirement decisions of individuals, some reforms are dealing with the two last variables. In order to focus attention on those reforms, we will assume that the contribution tax rate, which basically determines the size of the system, is given. Thus, we will concentrate on the relation between the legal retirement age and the redistributive character of the pension system by using a two-staged political economy model. This model is based on Casamatta et al. (2000). As they pointed out, the redistributive character of the pension system is an integral part of the definition of the system in itself. It implies specific institutional and administrative arrangements which cannot be overturned in the short run. For this reason, in the first constitutional stage the redistributive character of the Social Security program will be chosen by the government. In the second stage, individuals, differentiated at wage, will face a majority voting process on the legal retirement age, knowing exactly the redistributive level and voting accordingly. We leave the determination of the legal retirement age to the

political process since we want to reflect the popular support that changes in the retirement age may, or may not, have. In Switzerland, for instance, in 1998 there was a referendum on a single issue, in which the voters approved of a delay of two years in the female retirement age within the public pension from 62 to 64 (Bütler, 2002). At last, we will also consider away labor market distortions in order to avoid incentives problems.

Earlier literature dealing with retirement in a political economy environment has mainly focussed only on the effects of Social Security systems on the *individual* retirement decision.[1] Our paper examines the *legal* retirement age, which allows us to emphasize the relevance of the indirect 'macro' effects of changing the pensionable age, that is, the effects on pension benefits of altering the ratio workers/retirees, the well-known dependency ratio.

The term 'legal retirement age' usually refers to the age at which benefits are available. However, since there are strong incentives to stop working after this standard entitlement age, in this model we consider the legal retirement age as the age at which workers have to leave the labor force, that is, as a mandatory retirement.[2] Indeed, the average retirement age in some OECD countries is very

[1] See for instance, Sheshinski (1978), Crawford and Lilien (1981),Kahn (1988), or Fabel (1994). From a more general point of view, see Galasso and Profeta (2002) for a survey of the literature on the political economy of Social Security.

[2] In some countries there are direct restrictions on work above the standard age (Portugal or

close to this standard retirement age (e.g. the United Kingdom, Portugal or Ireland); see Blondal and Scarpetta (1998).[3]

The main findings of this study suggest that, for governments trying to postpone the pensionable age, it may be appropriate to accompany the deferment of the legal retirement age with an increase in the redistribution level of the pension system to ensure a higher political support. Besides, concerning the government's decision, we find two counterintuitive results. The political process in the second stage may have such a crucial impact that, on the one hand, governments acting under a right-wing criterion could have incentives to implement a pension system with some level of redistribution, and, on the other hand, governments acting under a left-wing criterion could have incentives to apply a pension system with no maximal redistribution in order not to extend excessively the working period.

The underlying reason is the following: agents with wages below average will delay their optimal legal retirement ages as the Social Security system is more and more redistributive; in consequence, when they are more than 50% of the

Spain make entitlements to pension benefits beyond the standard age conditional on complete withdrawal from work) or frequently, individuals have to leave their current jobs to receive their pensions; see Blondal and Scarpetta (1998) or Gruber and Wise (1999).

[3]If there is a possibility to have an early access to pension benefits with some adjustment in the value of retirement benefits, the average retirement age is usually found between this age at which pensions can be accessed and the standard retirement age; see Blondal and Scarpetta (1998) or Samwick (1998).

population, the usual case, a more redistributive pension benefits would lead to postpone the elected legal retirement age.

In summary, in those countries where some of the proposed reforms to solve the viability of the public pension systems is to postpone the pensionable age, an increase in the redistributive character of the pension system could lead to a larger social consensus.

The paper is organized as follows: section 2 develops the model. Section 3 analyzes the (second stage) majority voting process on the legal retirement stage; section 4 studies the government's decision (first stage) on redistribution level of the Social Security program according to three different criteria. Section 4 summarizes the main results.

## 2. The model

Consider a continuous distribution of agents on wage that will be located between a minimum and a maximum wage level, $[w_p, w_r]$, belonging to the same generation. As in most of industrialized countries, we consider that the median wage, $w_{med}$, is lower than the mean wage, $\varpi$. There is no uncertainty on the length of life. Each individual lives exactly $T$ years. On the first $R$ years the individual will be a full

time worker whereas on the following $T - R$ ones the individuals will be retired, being $R$ the current legal retirement age.

Individuals have a stationary and temporally independent utility function, which is separable and strictly increasing in consumption and leisure.[4] Leisure yields utility to the individual only when this individual is retired. So the only way utility coming from leisure can be modified is by changing the legal retirement age. The pension benefits are received only after they leave the labor force. The instantaneous utility function is, then, as follows

$$U\left(c_i^t, l^t\right) = u\left(c_i^t\right) + v\left(l^t\right) \tag{2.1}$$

where $c_i^t$ is the consumption at period $t$ of agent $i$. The utility of consumption is twice differentiable with $u' > 0$, $u'' < 0$. Let $l^t$ be the leisure at period $t$, being the utility of leisure $v\left(l_w^t\right) = 0$, in their working years and $v\left(l_R^t\right) = v$, in their retirement years. Besides, we assume that the elasticity of consumption marginal utility $\rho_r = -cu''\left(c\right)/u'\left(c\right)$ is non-increasing and smaller than one.[5]

The Social Security system is defined by a constant contribution rate $\tau \in [0, 1]$ and by a constant intra-generational redistribution degree $\alpha \in [0, 1]$. Pension

[4] Similar to Crawford and Lilien, (1981) or Sheshinski (1978).

[5] This elasticity is the well-known coefficient of relative risk aversion.

benefits may be financed through two different systems. On the one hand, a Pay-As-You-Go system (PAYG) where pension benefits of retirees are paid by working people through taxes. On the other hand, a Fully-Funded (FF) system where pension benefits of retirees are financed through the return of the taxes that they paid during their working life. In the PAYG system the return will depend on the population growth rate, while in the FF system will depend on the interest rate. Since we do not address the issue of PAYG vs. FF system, in our theoretical benchmark pension benefits will be identical under the two systems by considering both the interest rate and the population rate equal to zero.

Individuals plan consumption, savings and retirement in order to maximize the discounted value of utility subject to their lifetime budget constraint. While working individuals earn a fixed gross wage per unit of time $w_i \in [w_p, w_r]$. While retired they receive a constant stream of pension benefits per unit of time $p_i(R, \alpha, w_i)$ from the Social Security program.

For the sake of simplicity, we assume that savings earn no interest and that individuals do not discount the future. Then, the lifetime utility of the individual of wage $w_i$ can therefore be written as

$$\int_0^T U\left(c_i^t, l^t\right) dt = \int_0^R u\left(c_i^t\right) dt + \int_R^T \left[u\left(c_i^t\right) + v\right] dt, \tag{2.2}$$

and her lifetime budget constraint as

$$\int_0^T c_i^t dt = \int_0^R w_i \left(1-\tau\right) dt + \int_R^T p_i(\alpha, R, w_i) dt. \tag{2.3}$$

Separability and concavity of the instantaneous utility function, certain lifetimes, and perfect capital markets imply that, in order to maximize (2.2) subject to (2.3), each individual will set a constant level of consumption

$$c_i = \frac{1}{T}\left[Rw_i\left(1-\tau\right) + \left(T-R\right)p_i(\alpha, R, w_i)\right]. \tag{2.4}$$

Pension benefits per unit of time of the individual with wage $w_i$ will be equal to the following expression:

$$p_i(\alpha, R, w_i) = \frac{R}{T-R}\tau\left[\left(1-\alpha\right)\varpi + \alpha w_i\right] \tag{2.5}$$

where $R/\left(T-R\right)$ would be the well-known dependency ratio in a PAYG system and the ratio between working and retirement years in the FF system and $\left[\left(1-\alpha\right)\varpi + \alpha w_i\right]$ a linear combination of the mean wage, $\varpi$, and the individual's

wage, $w_i$. Depending on the level of $\alpha$, the type of Social Security may range from a totally uniform pension benefits scheme ($\alpha = 0$), usually referred as Beveridgean, to a type in which pension benefits are actuarially fair ($\alpha = 1$), usually referred as Bismarckian.[6]

## 3. Voting on the Legal Retirement Age

Given $\alpha$, the legal retirement age is chosen through a majority voting system. We must then identify the median voter and determine her preferred legal retirement age. Let $R^*(w_i)$ be the optimal legal retirement age of an individual of wage $w_i$. In order to get the optimal legal retirement age for each individual, we substitute (2.4) and (2.5) in (2.2), and after some simplifications, the optimization problem that the individual faces is as follows

$$\max_R U \equiv Tu\left(\frac{R}{T}\left[w_i(1-\tau)+\tau\left((1-\alpha)\varpi+\alpha w_i\right)\right]\right)+(T-R)v \tag{3.1}$$

From (3.1) the following proposition can be stated.

**Proposition 3.1.** *i)The utility function $U(R,w)$ is single-peaked in $R$.*

[6]See Casamatta et al. (2000) for a classification of several OECD countries depending on the redistribution character of the Social Security system.

*ii) The optimal legal retirement age increases with the wage. The agent with the median wage is the median voter.*

**Proof.** i) The first and second derivatives of the utility function of an individual of wage $w_i$ are

$$\frac{\partial U}{\partial R_i} = u'(c_i)\left[w_i(1-\tau) + \tau\left((1-\alpha)\varpi + \alpha w_i\right)\right] - v = 0 \tag{3.2}$$

$$\frac{\partial^2 U}{\partial R_i^2} = \left[w_i(1-\tau) + \tau\left((1-\alpha)\varpi + \alpha w_i\right)\right]^2 \frac{1}{T} u''(c_i) < 0 \tag{3.3}$$

Since (3.3) is negative for all $R$, preferences are single peaked with respect to $R$.

ii)From the F.O.C. of the maximization problem of the utility function (3.1), using the implicit function theorem and after some simplifications we obtain

$$\frac{\partial R^*(w_i)}{\partial w_i} = -\frac{\left[1-\tau(1-\alpha)\right]\left[u'(c)(1-\rho_r)\right]}{\left[w_i(1-\tau) + \tau\left((1-\alpha)\varpi + \alpha w_i\right)\right]^2 \frac{1}{T} u''(c_i)}. \tag{3.4}$$

This equation is strictly positive since the relative coefficient of risk aversion, $\rho_r$, is less than one. Q.E.D.

The first point of the proposition tells us that any individual has a unique op-

timal legal retirement age, and therefore, we can apply the median voter theorem in order to obtain the elected retirement age. The second point states that optimal retirement ages are increasing with the wage level.[7] This result arises because the negative substitution effect on leisure of a higher wage outweighs the positive income effect. Thus, the individual with the median wage will be the median voter, and consequently, $R^*(w_{med})$ will be the elected legal retirement age.[8]

Let us now analyze how optimal retirement ages of individuals change by altering the redistribution level of the system. The next proposition states the effect of $\alpha$ on the preferred legal retirement age.

**Proposition 3.2.** *Consider an individual with a wage level $w < \varpi$ ($w > \varpi$). The more redistributive the Social Security system, the higher (lower) her preferred retirement age.*

**Proof.** From F.O.C. of maximization problem (3.1), the implicit function theorem and after some simplifications, we obtain

$$\frac{\partial R^*(w_i)}{\partial \alpha} = -\frac{\tau(w_i - \varpi)\left[u'(c)(1-\rho_r)\right]}{\left[w_i(1-\tau) + \tau\left((1-\alpha)\varpi + \alpha w_i\right)\right]^2 \frac{1}{T} u''(c_i)} \tag{3.5}$$

[7] This result is similar to that obtained in the analysis of optimal *individual* retirement decision in the previous literature.

[8] We suppose voters have no strategic behaviour. They vote for the closest age to their own optimal retirement age.

Since $\rho_r < 1$, if $w < \varpi$ $(w > \varpi)$ then $\partial R^*(w_i)/\partial\alpha < 0$ $(> 0)$. Q.E.D.

An increase in the redistribution level of the pension system causes a positive effect on the optimal decision of the workers with $w < \varpi$.[9] That is, the more redistributive the pension system is, the more benefits low-wage workers obtain from postponing the retirement age. The reason is the positive indirect effects of this postponement, via dependency ratio, on the pension benefits. Therefore, in order to increase the size of the Social Security system and to reduce their private savings, they will prefer to delay the legal retirement age. So, since we have assumed that the median wage is lower than the mean one, $w_{med} < \varpi$, a more redistributive pension system would lead to a higher elected legal retirement age.

This result contrasts with that obtained in models in which the pension system allows for flexible retirement. In those cases, when the retirement decision is analyzed, it is found that a more redistributive system reduces optimal *individual* retirement ages. It is considered, first, that the pension system imposes a implicit tax on postponing retirement and secondly, that this implicit tax is higher, the more redistributive the system is (see Casamatta et al., 2002).

[9] Since the two discount factors are equal to zero and there are no borrowing constraints, both redistributive parameters, $\alpha$ and $\tau$, would cause the same effect on the preferred legal retirement age.

Therefore, reforms of public pension systems aiming to delay the retirement decision by increasing the flexibility of the retirement scheme should be implemented together with increases in the actuarial fairness of the system, in other words, together with a reduction in the redistributive character of the system. In this way, the relation between lifetime contributions and pension benefits would be stronger and disincentives to work would be lower.

However, when the pension system reform is a postponement of the legal age of entitlement (as in New Zealand, Japan or Italy; see Blondal and Scarpetta, 1998), our model suggests that, in order to increase the political support, the reform should be accompanied by increases in the redistributive character of the system, since it would reduce the rejection of the majority of workers, those with wages lower than the mean one, by improving their pension benefits.

## 4. The Constitutional Stage: Choosing $\alpha$

Let us now analyze how the degree of redistribution is determined at the constitutional stage. We define three social welfare criteria, the *Downsian,* the *left-wing* and the *right-wing criterion*. A government with a *Downsian criterion* will care only about the median citizen. And a government with a *left-wing criterion* (*right-*

*wing criterion)* will care only about the poorest (richest) people.

If the political parties do not have policy preferences and the policy space is one dimensional then the only possible government criterion in equilibrium is the Downsian one. But if parties are ideological ones and they are uncertain about preferences of voters then they may have different criteria in equilibrium. Therefore, as Lee (1999), we simply assume that the three criteria are possible and analyze the results under each one.

The government chooses the level of redistribution taking into account the effect on the future voting process on $R$. Let us define $R^e(\alpha) = R^*(w_{med})$ as the future elected legal retirement age. So, the government solves the following problem

$$\max_{\alpha} V_i\left(R^e(\alpha), \alpha\right) \equiv \max_{\alpha} Tu\left(c_i\left(\alpha\right)\right) + \left(T - R^e(\alpha)\right) v \tag{4.1}$$

being $V_i$ the indirect utility function of the individual with wage $w_i$. Let $\alpha_{med}, \alpha_r$ and $\alpha_p$be respectively the solution to (4.1) for the individual with the median, the highest and the poorest wage respectively.

By differentiating $V_i\left(R^e(\alpha),\alpha\right)$ with respect to $\alpha$ we get

$$\frac{dV_i}{d\alpha}=\frac{\partial V_i}{\partial \alpha}+\frac{\partial V_i}{\partial R}\frac{\partial R^e(\alpha)}{\partial \alpha} \tag{4.2}$$

where the first term, $\partial V_i/\partial\alpha$, gives us the direct impact on the individual's utility of a change in the redistribution degree, $\alpha$, and the second term, $\left(\partial V_i/\partial R\right)\left(\partial R^e(\alpha)/\partial\alpha\right)$, reflects the indirect impact on the utility, as a consequence of the change in the retirement age chosen by the median voter.

So, depending on the criterion, we can obtain the following results.

**Proposition 4.1.** *i) A Downsian criterion will imply maximal redistribution.*

*ii) A right-wing criterion does not always imply no redistribution.*

*iii) A left-wing criterion does not always imply maximal redistribution.*

**Proof.** i) By differentiating (4.1) with respect to $\alpha$ for the individual with median wage we get

$$\frac{dV_{med}}{d\alpha}=\frac{\partial V_{med}}{\partial \alpha}+\frac{\partial V_{med}}{\partial R}\frac{\partial R^e(\alpha)}{\partial \alpha} \tag{4.3}$$

Since $w_{med}<\varpi$, the direct impact is always negative

$$\frac{\partial V_{med}}{\partial \alpha}=u'\left(c_{med}\right)R^e(\alpha)\tau\left(w_m-\varpi\right)<0. \tag{4.4}$$

With respect to the sign of the indirect impact,

$$\frac{\partial V_{med}\left(R^e(\alpha),\alpha\right)}{\partial R} \tag{4.5}$$

and

$$\frac{\partial R^e(\alpha)}{\partial \alpha}, \tag{4.6}$$

since the utility function is evaluated at $R^e(\alpha)$, (4.5) is always equal to zero. Hence, the indirect impact is zero.

Therefore, (4.3) is always negative which implies that $\alpha_{med} = 0$.

ii) and iii) These points are numerically proved in the appendix. Q.E.D.

We have seen that changes in the redistribution degree lead to changes in the elected retirement age, which affects indirectly the agent's utility. But this indirect effect will be null for the median worker since the elected retirement age will be her own optimal one, hence, her optimal redistribution degree will only depend on the relation between the median and the mean wage. Therefore, since under Downsian criterion the government will only care about the worker of median wage, and since $w_{med} < \varpi$, the first point of the proposition states that a

government with a Downsian criterion would implement a Social Security system with maximal redistribution.

With a right-wing criterion, the government chooses the intra-generational redistribution level of the pension system in order to maximize the utility of the rich people, in our model represented by the individual with the highest wage, $w_r$.

Thus, the government solves the following problem

$$\max_{\alpha} V_r\left(R^e(\alpha), \alpha\right) \equiv \max_{\alpha} Tu\left(c_r\left(\alpha\right)\right) + \left(T - R^e(\alpha)\right) v. \tag{4.7}$$

By differentiating (4.7) with respect to $\alpha$ we again get

$$\frac{dV_r}{d\alpha} = \frac{\partial V_r}{\partial \alpha} + \frac{\partial V_r}{\partial R}\frac{\partial R^e(\alpha)}{\partial \alpha}. \tag{4.8}$$

The direct impact will always be positive since the less redistributive the program is, the higher the utility of the richest worker would be. But, with respect to the indirect impact, we have to highlight the following. Since the optimal retirement age of the richest individual, $R^*(w_r)$, is higher than the elected one, $R^e(\alpha)$, and taking into account the single peakness of the preferences, if the elected retirement age were delayed, the difference between $R^*(w_r)$ and $R^e(\alpha)$ would be

shorter. And this would positively affect her utility. Therefore, since an increase in the redistributive character of the system would postpone the optimal retirement age of the median worker, and consequently the elected one, the indirect impact of a less redistributive system will be negative.

As we can see in the numerical example of the appendix, when the indirect effect outweighs the direct effect, the government will implement a positive redistribution degree, i.e., $\alpha_r < 1$.In other words, to achieve a higher legal retirement age, the richest people would be in favor of a pension system with some level of intra-generational redistribution.

For the same reason than in the previous point, the conflict between the direct and the indirect effect, the third point of the proposition tells us that, under a left-wing criterion, it would be possible pension benefits with some positive earning-related part, that is, with no maximal redistribution. In this last case, the government would maximize the utility of the lowest wage ($w_p$) individuals, $V_p$.

Thus, the government would choose the $\alpha$ that solves the following problem

$$\max_{\alpha} V_p\left(R^e(\alpha), \alpha\right) \equiv Tu\left(c_p\left(\alpha\right)\right) + \left(T - R^e(\alpha)\right) v. \tag{4.9}$$

Again we can divide the total effect of an increase in $\alpha$ (a reduction in the redistributive character of the system) into a direct and an indirect effect. By differentiating (4.9) with respect to $\alpha$ we get

$$\frac{dV_p}{d\alpha} = \frac{\partial V_p}{\partial \alpha} + \frac{\partial V_p}{\partial R}\frac{\partial R^e(\alpha)}{\partial \alpha}. \tag{4.10}$$

Under the left-wing criterion the reasonings are equal to those derived from the right-wing criterion but in the opposite way. On one hand, the direct impact will always be negative. A less redistributive pension system would reduce the income of the poorest people by decreasing their pension benefits, which would directly affect their utility levels in a negative way. On the other hand, for the individual with the lowest wage, the indirect effect will always be positive. The elected legal retirement age, $R^e(\alpha)$, is higher than the optimal retirement age of the poorest individual, $R^*(w_p)$, that is, the individual with the lowest wage is working more than her optimum. Consequently, an increase in $\alpha$, a reduction in the redistributive character of the Social Security system that reduces this elected retirement age by decreasing the median voter's optimal one, will indirectly improve the utility level of the poorest individual by reducing her working years.

So, we obtain again opposite effects, and therefore, as we can see in the ap-

pendix, when the indirect effect outweighs the direct effect, the preferred pension benefits of the poorest people will have a positive earning-related part, i.e., $\alpha_p > 0$, in order to achieve a lower legal retirement age in the subsequent voting process.

In summary, we have analyzed three different criteria in order to determine the redistributive character of the Social Security system. Under *Downsian criterion* the optimal level of redistribution will depend only on the relation between the median and the mean wage. Since future changes in the elected legal retirement age will not affect to the median wage worker, given that the elected retirement age will be her optimal one, and since $w_{med} < \varpi$, there will be maximal redistribution.

Nevertheless, under *right-* and *left-wing criterion,* since the future effects on the elected retirement age derived from the choice of the redistributive character of the pension system have to be taken into account, it would be possible to find counterintuitive results, that is, a pension system with a positive level of redistribution, in spite of a right-wing government, or pension benefits with a positive earning-related part implemented by a left-wing government.[10]

[10]It is easy to check that if the government could implement both parameters $(R, \alpha)$, the optimal redistribution degree would respectively be no redistribution, $\alpha_r = 1$, for the right-wing criterion, and total redistribution, $\alpha_p = 0$, for the left-wing criterion. But, our point is that changes in the pensionable age will only be achieved by governments with the support of a vast majority of the population. For that reason we consider a *second-best option* scheme. The government chooses a parameter $(\alpha)$ and people choose the other one $(R)$.

## 5. Conclusions

One of the main reforms to solve the viability of public pension systems is to delay the pensionable or the legal retirement age. Our paper suggests that, if this reform were finally implemented, in order to obtain a bigger political support it would be appropriated to associate it with an increase in the redistributive character of the pension system, since it would delay preferred legal retirement ages of the majority of workers by improving their pension benefits.

We illustrate this result using a two-staged political economy model where, in the first stage, the government decides the redistribution level of the Social Security program and, in the second one, individuals face a majority voting process on the legal retirement age. And we obtain that, in order to achieve a high enough legal retirement age, even if the government cares only about the richest people the pension system would be set with a positive intra-generational redistribution degree. Surprisingly, we also find that the poorest people would be against a pension system totally redistributive if this system implies to work too long.

To sum up, from our results it can be deduced that governments trying to postpone the legal retirement age should take into account that an increase in the redistributive level of the pension system could guarantee a large social consensus.

This implies that it will not always be useful to strength the link between lifetime contributions and pension benefits, one of the more habitual measures that is being proposed to encourage people to work longer. This measure should only be applied together with reforms aimed to increase the flexibility of the pension system's retirement rules.

# 6. Appendix

## 6.1. Numerical example

These numerical examples illustrate two cases where respectively the richest people are better off with some degree of redistribution than with no redistribution, and for that reason the implemented redistribution degree under a right-wing criterion would be strictly positive, that is, $\alpha_r < 1$, and the case where the poorest people are better off with some positive earning-related part in the pension benefits, which will lead to a redistribution degree implemented by a left-wing criterion government different from the maximal one, $\alpha_p > 0$.

Our benchmark example is as follows:

$$U(c) = \frac{c^{1-\rho}}{1-\rho} \tag{6.1}$$

with $\rho = 0.1$. A wage distribution with the following characteristics: $w_p = 0.5w_{med}$, $\varpi = 1.5w_{med}$, $w_r = 2w_{med}$ and $\tau = 0.3$.

We first have to determinate $R^*(w_{med})$, i.e., the optimal retirement age of the median voter. The optimization problem that this individual faces is as follows

$$\max_R U \equiv Tu\left(\frac{R}{T}W_{med}\right) + (T-R)\,v \tag{6.2}$$

where $W_{med} = w_{med}(1-\tau) + \tau\left((1-\alpha)\,\varpi + \alpha w_{med}\right)$ with $W_{med} = w_{med}$ if $\alpha = 1$.

According to this, we obtain the first order condition

$$\frac{\partial U}{\partial R} = c^{-\rho}W_{med} - v = 0 \Leftrightarrow \frac{kW_{med}}{\left(\frac{R}{T}W_{med}\right)^{\rho}} = v. \tag{6.3}$$

Then the optimal retirement age of the median voter is given by

$$R^*(w_{med}) = \frac{TW_{med}^{\frac{1-\rho}{\rho}}}{v^{\frac{1}{\rho}}}. \tag{6.4}$$

Now, we calculate the utility of the individual evaluated at $R^e(\alpha) = R^*(w_{med})$, that is, the retirement age given by the voting process, and we obtain the indirect utility of the individual with wage $w_i$,

$$V_i\left(R^e(\alpha),\alpha\right) \equiv Tu\left(c_i\left(\alpha\right)\right) + \left(T - R^e(\alpha)\right)v. \tag{6.5}$$

Substituting (6.4) in the utility function we obtain

$$V_i\left(R^e(\alpha),\alpha\right) \equiv T\frac{\left(\frac{W_i W_{med}^{\frac{1-\rho}{\rho}}}{v^{\frac{1}{\rho}}}\right)^{1-\rho}}{1-\rho} + \left(T - \frac{TW_{med}^{\frac{1-\rho}{\rho}}}{v^{\frac{1}{\rho}}}\right)v. \tag{6.6}$$

We just have to prove that the utility of the richest individual is higher with some positive level of redistribution than with no redistribution, and that the utility of the poorest individual is higher with some positive earning-related part in the pension benefits than with a totally redistributive pension benefits. In other words, we have to prove respectively

$$V_r\left(R^e(\alpha),\alpha<1\right) > V_r\left(R^e(\alpha),\alpha=1\right) \tag{6.7}$$

and

$$V_p\left(R^e(\alpha),\alpha>0\right) > V_p\left(R^e(\alpha),\alpha=0\right). \tag{6.8}$$

If (6.7) and (6.8) hold, then $\alpha_r < 1$ and $\alpha_p > 0$, that is, a right-wing government would choose a positive level of redistribution, and on the contrary, a left-wing

government would not choose total redistribution.

Given that $w_r = aw_{med}$, $\varpi = bw_{med}$, and $w_p = dw_{med}$ with $a > b > 1 > d$, after some simplifications, (6.7) will be true if

$$\frac{1}{1-\rho}\left(\left(a\left(1-\tau\right)+\tau((1-\alpha)b+\alpha a)\right)\left(1-\tau+\tau((1-\alpha)b+\alpha)\right)^{\frac{1-\rho}{\rho}}\right)^{1-\rho}$$

$$-\left(1-\tau+\tau((1-\alpha)b+\alpha)\right)^{\frac{1-\rho}{\rho}}-(\frac{a^{1-\rho}}{1-\rho}-1)>0. \tag{6.9}$$

On the other hand, (6.8) will be true if

$$\frac{1}{1-\rho}\left(\left(d\left(1-\tau\right)+\tau((1-\alpha)b+\alpha d)\right)\left(1-\tau+\tau((1-\alpha)b+\alpha)\right)^{\frac{1-\rho}{\rho}}\right)^{1-\rho}$$

$$-\left(1-\tau+\tau((1-\alpha)b+\alpha)\right)^{\frac{1-\rho}{\rho}}$$

$$-\left(\frac{1}{1-\rho}\left(\left(d\left(1-\tau\right)+\tau b\right)\left(1-\tau+\tau b\right)^{\frac{1-\rho}{\rho}}\right)^{1-\rho}-\left(1-\tau+\tau b\right)^{\frac{1-\rho}{\rho}}\right)>0. \tag{6.10}$$

It is easy to check that (6.9) and (6.10) hold for values such as $a = 2$, $b = 1.5$,

$d = 0.5$ and $\tau = 0.3$; the values of the benchmark case, and using $\alpha = 0.5$ for the two comparisons.

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