Universidad de la República
Facultad de Ciencias Sociales
DEPARTAMENTO DE ECONOMIA

Documentos de trabajo

Electoral competition and the unfunding of public pension programs

Alvaro Forteza

Documento No. 01/01
Diciembre, 2001

Electoral Competition and the Unfunding of Public Pension Programs *

Alvaro Forteza†

March, 2001
Working Paper 01/2001

Abstract

Most public pension systems failed to build pension funds, even when it was clear that the benefits the systems were paying could not be sustained in the long run. I argue in this paper that politicians ruling public pension programs have strong incentives to exhaust the pension funds, offering generous pensions to old voters to raise the probability of winning the elections. Young voters do not support those electoral proposals to spend the pension fund, since a reduction of the fund will pull pensions down when they retire. The pension fund does not survive if old voters prevail, something that is likely to happen in the model in this paper despite of old voters being less than young voters. Electoral competition favors the elderly because they tend to be more willing to change their vote for a good pension than are young voters to change their vote for a larger pension fund.

Keywords: Electoral Competition, Pensions, Probabilistic Voting.

JEL: E690, H550

*Comments by Martín Rama were very useful in revising this paper. The usual disclaimer applies.

†Departamento de Economía, Facultad de Ciencias Sociales, Universidad de la República, José Enrique Rodó 1854, CP 11200, Montevideo, Uruguay. Electronic mail: Alvarof@decon.edu.uy

1 Introduction

Most public pension systems failed to build pension funds, even when it was clear that they were becoming unsustainable in the long run. As a general rule, pension systems covered small segments of the population at the inception. The number of retirees tended to be small relative to the number of contributors during the initial years. The gradual expansion of social security coverage, with the inclusion of new contingents of contributors, helped to keep the retirees-contributors ratios low for a while. Eventually, as the systems matured, the ratios rose. In recent decades, the aging of the population has contributed to further increase these ratios. Nevertheless, neither the maturing of the pension systems nor the aging of the population necessarily imply that the ratio of benefits to contributions must deteriorate. Social Security systems can build pension funds in periods in which the pension bill is known to be temporary low in order to finance pensions when the retirees-contributors ratio becomes less favorable. However, most systems have failed to build these funds in practice, and have faced financial difficulties as a result.

The model in this paper provides an explanation for the failure of public pension systems to accumulate funds. The main hypothesis is that politicians have exhausted the pension funds, giving generous pensions to raise their probability of winning elections. This is a model of a representative democracy in which citizens must choose among two competing office-seeking candidates. In order to win the elections, the candidates make (binding) promises in several fronts, including pensions for the currently old citizens. Candidates cannot credibly offer good pensions to the currently young voters, because those pensions will be decided in the future by other politicians, after new elections. What current candidates can offer to woo young voters is not to spend the pension fund, leaving the pension system administration in a better position to grant good pensions in the future. Therefore, while old voters push politicians towards more spending, young voters do the opposite. The pension fund does not survive if old voters prevail, something that is likely to happen in this model despite of old voters being less than young voters.

The advantageous position of the elderly in this paper comes from the asymmetric ability of politicians to channel transfers to young and old citizens through the pension system. Politicians can more effectively gain votes from old citizens granting better current pensions than from young citizens preserving the pension fund. Young voters could be interested in the pension fund if they thought that a large fund warrants a good pension for them. But if young voters saw that the current administration preserves the fund paying modest pensions, they should think that the following administration could do the same, in which case the fund would not benefit them. Therefore, young voters may not be especially interested in the pension fund, failing to "discipline" politicians to preserve the fund.

The idea that old voters are more responsive than young voters to pension issues in terms of votes looks consistent with the facts. Mulligan and Sala-i-Martin (1999) put it in this way: "The most important concern among elderly voters are government old age subsidies and is believed by many politicians that the votes of the elderly are much more elastic to a candidate's stance on old age subsidies than are the votes of any other group to any other issue". The model in this paper provides an explanation of why this could be so, and explores its consequences for the working of the pension system.

The politico-economic equilibria described in this paper show that a pension system administration driven by electoral competition is likely to exhaust the fund during its first years and to pay decreasing pensions to successive generations. This theory is consistent with the evolution of actual institutions in many countries. Most public pension systems are currently fully unfunded, but not all of them were initially so. Nevertheless, one way or another, accumulated reserves were progressively eroded (Disney,1996, p 59; World Bank, 1994; Mulligan, 2000). German pension funds lost their assets during the world wars. Greece, Italy, Portugal, Spain, and Turkey granted generous pensions that were unsustainable in the long run (Disney 1996, p 85). Some Latin American countries extended benefits to new segments of the population without previously requiring contributions from the new beneficiaries.[1]

Fears of political misuse of the trust fund are currently informing the political debate on Social Security reform in the United States. Critics of the "advance funding" proposal in anticipation of future solvency problems argue that the Congress will likely use the fund to increase benefits or reduce taxes or spend them for other purposes (Diamond, 1999, p 99; Mulligan,

[1] In terms of Mesa-Lago and Bertranou (1998, p 27): "Political parties have also created new programs or liberalized the existing ones to the covered population. These concessions have usually preceded national elections: the party in power has passed legislation to get popular support and the parties in the opposition have promised those changes if they are elected." (Translated from the original Spanish version).

2000). Munnell (1998) has proposed a complete separation of the Social Security budget from the rest of the budget. However, as Alesina (2000) points out “this step might avoid using the Social Security surplus for discretionary spending, but it would not avoid increasing Social Security benefits for current generations of voters at the expense of future generations”. This is precisely what the politicians ruling Social Security do in the model presented in this paper.

Existing theories of electoral competition in social security have adopted a majority voting framework (Browning 1975, Hu 1982, Boadway and Wildasin 1989, Tabellini 1991, Casamatta, Cremer, and Pestieau 1998). However, in modern representative democracies policies are usually not decided by direct majority voting by the citizenship, as the majority voting model assumes (Tullock 1998). Citizens vote for political parties that represent them in many different dimensions, some of which become apparent only after elections. The promises candidates make on social security, even if binding, refer to just one of the many issues involved in an election. Probabilistic voting represents this decision process more accurately than majority voting. More importantly, the choice of the model matters because the outcome of these models is generally different. While in majority voting politicians please the median voter, in a probabilistic voting environment political parties must please the mobile voters, those that are more willing to exchange votes for economic benefits (Persson and Tabellini 2000).

The assumption of a direct vote for the pay-as-you-go pension system has faced the majority voting models of social security with the challenge of explaining why the median voter, who is typically an active worker, would vote for a program that favors the retirees. According to Mulligan and Sala-i-Martin (1999), these theories include one of the following additional hypotheses to deal with this difficulty: a) the elderly ally themselves with some poor young voters (Tabellini 1991), b) there is only one election in which the vote is for a stationary policy (Browning 1975). However, these additional hypotheses confront problems. Mulligan and Sala-i-Martin argue that the idea of a winning coalition of the elderly and the poor is to a large extent imposed: other coalitions could be formed with equal chances of winning. In turn, Browning’s model is not robust to “temporary suspension”: young and middle-aged voters would conform a majority voting for a suspension of the transfers to the old for one period. The same logic would drive to a suspension in the following periods, however, and the system would never get political support.

The probabilistic voting model does not face the problem considered in the previous paragraph. While the decisive voter in majority voting is an active worker that may not be particularly interested in favoring the elderly, old voters may become decisive in probabilistic voting. Old voters tend to be more responsive to offers related to pensions than young voters because politicians are more able to commit pensions in the near than in the far future. The most a candidate can offer to please young voters is to observe fiscal discipline, abstaining from giving too generous pensions to the currently old citizens. Therefore, while old citizens must be very sensitive to current pension issues, young voters only care about them when the situation becomes critical and major reforms are being analyzed. In normal times, young citizens base their votes on other issues.

2 The model

2.1 Description of the society

The economy is small and open. Capital moves freely across frontiers and interest parity holds. Hence, the domestic interest rate is equal to the international rate, which I assume constant for simplicity.

Production is carried on by a large number of competitive firms that combine labor and capital to produce output. The technology exhibits constant returns to scale.

The society is populated by a large number of citizens who live two periods. N_{t-1} old citizens and N_t young citizens live in period t. Individuals work during their first period of life and are retirees during the second. In period t, a young citizen earns the pre-tax wage w and chooses young-age consumption $(c_{y,t})$, and young age savings (s_t). He pays a social security contribution τ and expects to receive the pension p_{t+1} when he is old. In $t+1$, citizens who were born in t are old and consume $(c_{o,t+1})$. The preferences among young and old age consumption can be represented by a concave utility function: $u(c_{yt}) + \beta u(c_{ot+1})$.

Political parties A and B compete in elections that take place in every period. Politicians maximize the probability of winning the elections.[2]

[2] The results do not change if political parties are assumed to maximize the number of votes rather than the probability of winning the elections (Lindbeck and Weibull, 1987; Dixit and Londregan, 1996; Persson and Tabellini, 2000, p 177).

They care about the performance of the economy if and only if the economic performance affects their probability of winning the elections. During the electoral campaign, A and B commit pensions to be paid to the currently old $\left(p_t^A, p_t^B\right)$ and a pension fund to be left for the following period $\left(A_{t+1}^A, A_{t+1}^B\right)$. Citizens consider these electoral platforms in deciding their vote, because politicians are assumed to be able to commit to the promises made in the electoral campaign.[3] Young citizens are interested in the pension fund as far as they think that the next period pension is a function of the pension fund: $p_{t+1} = p_{t+1}\left(A_{t+1}\right)$.

Citizens care about other attributes of political parties as well, so they have partisan preferences. There is no unanimity in this respect. Partisan preferences for B relative to A have an individual-specific component (σ) and a whole-population component (δ); the former is variable across individuals and the latter is a parameter of the population. Following previous literature (Persson and Tabellini 2000), I assume that the partisan preference parameters can be added to the utility from consumption to get total utility $u\left(c_{yt}^B\right) + \beta u\left(c_{ot+1}^B\right) + \sigma + \delta$, if B is in office, and $u\left(c_{yt}^A\right) + \beta u\left(c_{ot+1}^A\right)$, if A is in office.

The partisan preference parameters are not generally known with certainty. Citizens can only be certain about their individual-specific parameter σ. The cumulative distribution functions $\Delta(\delta)$ and $H(\sigma)$ are known by everybody.

The budget constraint of the pension system is:

$$A_t(1+R) + N_t\tau - N_{t-1}p_t = A_{t+1}\ ,\ t \geq 0 \tag{1}$$

The beginning of the pension system takes place in $t = 0$. The system begins with no pension fund $(A_0 = 0)$, but it can build a fund during this or the following periods.

The public pension system is assumed to be unable to issue debt: $A_t \geq 0$. The results do not change qualitatively if the system is allowed to build some debt, provided there is an upper bound. This assumption is more stringent than the no-Ponzi-game condition that is often imposed on governments, but it looks realistic.

The timing in each period is as follows: a) Political parties choose electoral platforms $\left(A_{t+1}^A, p_t^A\right)$ and $\left(A_{t+1}^B, p_t^B\right)$. b) Elections take place. c) The

[3] Office-motivated politicians have no incentives to do after elections anything different from what they promised before elections. The commitment assumption is more controversial when politicians are motivated by the outcome of policies.

winning party implements the announced policy, firms produce, and citizens choose consumption. These three steps repeat period after period from $t = 0$ onwards.

2.2 The politico-economic equilibrium

Definition 1 *a politico-economic equilibrium is a situation such that: a) parties choose their political platforms to maximize their probability of winning the elections, taking as given the other party's platform; b) citizens choose consumption and vote to maximize their utilities; c) citizens and politicians correctly anticipate the function that maps the pension fund into pensions to be paid one period ahead.*

The main difficulty to fully characterize the solution is that the function mapping the pension fund into the following period pensions is unknown. Furthermore, this function depends on the particular form of the utility function $u(c)$. Hence, I present first the conditions for an optimum in the general case, and move then to the fully specified solution in the particular case of logarithmic utility.

2.2.1 The general case

The solution is obtained by backward induction.

After period t elections, firms choose the capital-labor ratio that minimizes costs. The optimum capital-labor ratio is a function of the international interest rate. In equilibrium, wages must be equal to the marginal product of labor evaluated at the optimum capital-labor ratio. The assumption of a constant international interest rate implies that the capital-labor ratio and the wage are constant.

Young citizens choose consumption solving the following program:

$$\underset{Cyt,Cot+1}{Maximize} \; u(c_{yt}) + \beta u(c_{ot+1}) \tag{2}$$

$$st \;:\; c_{yt} + \frac{c_{ot+1}}{1+R} \leq w - \tau + \frac{p_{t+1}(A_{t+1})}{1+R} \tag{3}$$

Their utility in the optimum is:

$$U_y\left(p_{t+1}\left(A_{t+1}\right)\right)=u\left(c_y\left(p_{t+1}\left(A_{t+1}\right)\right)\right)+\beta u\left(c_o\left(p_{t+1}\left(A_{t+1}\right)\right)\right) \tag{4}$$

with derivative:

$$U_y'\left(p_{t+1}\left(A_{t+1}\right)\right)=\frac{u'\left(c_y\left(p_{t+1}\left(A_{t+1}\right)\right)\right)}{1+R}=\beta u'\left(c_o\left(p_{t+1}\left(A_{t+1}\right)\right)\right) \tag{5}$$

At this stage, citizens know A_{t+1} from the political platform of the winning party. More difficult is to guess the function $p_{t+1}\left(A_{t+1}\right)$, but period t elections are informative in this respect. For the moment, I simply assume that citizens correctly guess this function. I will come back to this issue after having analyzed the determination of the political platforms.

Old citizens solved an analogous program in the previous period. Their utility in the optimum in period t is:

$$U_o\left(p_t\right)=u\left(c_o\left(p_t\right)\right)=u\left(s_{yt-1}\left(1+R\right)+p_t\right) \tag{6}$$

A change in p_t that is expected in $t-1$ causes an increase in old and young age consumption. The increase in old age consumption is thus smaller than the expected increase in the pension. But when politicians must decide on current period pensions, young age consumption and savings $\left(s_{yt-1}\right)$ are already given. Now, old age consumption varies one to one with pensions. Therefore the derivative of the old citizens indirect utility is:

$$U_o'\left(p_t\right)=u'\left(c_o\left(p_t\right)\right) \tag{7}$$

A citizen is indifferent between voting for A or B in period-t elections, if his individual partisan preference is σ_{yt} or σ_{ot} (if he is young or old, respectively) such that:

$$\begin{aligned} U_y\left(p_{t+1}\left(A_{t+1}^A\right)\right) &= U_y\left(p_{t+1}\left(A_{t+1}^B\right)\right)+\sigma_{yt}+\delta && (8)\\ U_o\left(p_t^A\right) &= U_y\left(p_t^B\right)+\sigma_{ot}+\delta && (9)\end{aligned}$$

Citizens with a partisan preference σ lower than these thresholds vote for A. Hence the number of votes for A among young $\left(V_{yt}^A\right)$ and old $\left(V_{ot}^A\right)$ voters is:

$$\begin{aligned} V_{yt}^A &= N_t H\left(\sigma_{yt}\right)=V_y^A\left(p_{t+1}\left(A_{t+1}^A\right),p_{t+1}\left(A_{t+1}^B\right),\delta,N_t\right) && (10)\\ V_{ot}^A &= N_{t-1} H\left(\sigma_{ot}\right)=V_o^A\left(p_t^A,p_t^B,\delta,N_{t-1}\right) && (11)\end{aligned}$$

Assuming there is no abstention, the number of votes for A is equal to the number of votes for B if the whole-population partisan preference parameter is δ^* such that:

$$V_y^A\left(p_{t+1}\left(A_{t+1}^A\right), p_{t+1}\left(A_{t+1}^B\right), \delta^*, N_t\right) + V_o^A\left(p_t^A, p_t^B, \delta^*, N_{t-1}\right) = \frac{N_{t-1}+N_t}{2} \tag{12}$$

Party A wins the election if $\delta < \delta^*$. Therefore, the probability that A wins the election is $\Delta\left(\delta^*\right)$.

Before elections, political parties choose their electoral platforms to maximize the probability of winning the elections.[4] Party A solves the following program:

$$\underset{p_t^A, A_{t+1}^A, \delta^*}{Maximize} \Delta\left(\delta^*\right) \tag{13}$$

$$s.t.$$

$$V_{yt}^A + V_{ot}^A = \frac{N_{t-1}+N_t}{2} \tag{14}$$

$$A_t\left(1+R\right) + N_t\tau - N_{t-1}p_t^A = A_{t+1}^A \tag{15}$$

$$A_{t+1}^A \geq 0 \tag{16}$$

Let λ_1, λ_2 and λ_3 be the multipliers of the constraints 14 to 16, respectively. The first order conditions are:

$$\lambda_1 H'\left(\sigma_{ot}\right) U_o'\left(p_t^A\right) - \lambda_2 = 0 \tag{17}$$

$$\lambda_1 N_t H'\left(\sigma_{yt}\right) U_y'\left(p_{t+1}\right) p_{t+1}'\left(A_{t+1}^A\right) - \lambda_2 + \lambda_3 = 0 \tag{18}$$

$$\Delta'\left(\delta^*\right) - \lambda_1\left[N_t H'\left(\sigma_{yt}\right) + N_{t-1}H'\left(\sigma_{ot}\right)\right] = 0 \tag{19}$$

$$A_{t+1}^A\lambda_3 = 0 \quad , A_{t+1}^A \geq 0, \;\; \lambda_3 \geq 0 \tag{20}$$

plus 14 and 15.

[4] Following previous authors, I assume that each party's probability of winning is a quasi-concave function of the variables under his control, and a continuous function of the variables under the other party's control (Dixit and Londregan 1996, Lindbeck and Weibull 1993). These are sufficient conditions for the existence of a Nash equilibrium, according to Glicksberg's theorem (Fudenberg and Tirole 1992). In the model in this paper, concavity of the distribution functions for the partisan preference parameters is a sufficient condition for the quasi-concavity of the payoff function. If the distribution functions are not concave, the probability of winning the election can still be quasi-concave if the utility function $u\left(c\right)$ is sufficiently concave.

Party B solves an analogous program. Focusing on symmetric Nash equilibria: $p_t^A = p_t^B$ and $A_{t+1}^A = A_{t+1}^B$. Therefore:

$$\sigma_{ot} = \sigma_{yt} = -\delta^* \tag{21}$$

Equations 5, 7, 17, 18, 20 and21 imply that:

$$\frac{U_o'\left(p_t^A\right)}{U_y'\left(p_{t+1}\left(A_{t+1}^A\right)\right)} = \frac{u'\left(c_o\left(p_t^A\right)\right)}{\beta u'\left(c_o\left(p_{t+1}\left(A_{t+1}^A\right)\right)\right)} \begin{cases} = N_t p_{t+1}'\left(A_{t+1}^A\right) & , if \;\; A_{t+1}^A > 0 \\ \geq N_t p_{t+1}'\left(A_{t+1}^A\right) & , if \;\; A_{t+1}^A = 0 \end{cases} \tag{22}$$

In the interior solution $\left(A_{t+1}^A > 0\right)$, the marginal rate of substitution in the left hand side of 22 equals the marginal rate of transformation in the right hand side of the equation. In a corner solution $\left(A_{t+1}^A = 0\right)$, the marginal rate of substitution is equal to or larger than the marginal rate of transformation. In the latter case, politicians would like to increase current pensions reducing the pension fund, to take advantage of the comparatively high marginal utility of old citizens that implies a high responsiveness of old citizens to transfers in terms of votes. But politicians cannot do it, because the pension fund is already at its minimum.

Politicians will not leave a positive pension fund for period $t+1$, unless they expect a positive response of the next period pension to the pension fund. Leaving a positive fund involves a sacrifice in terms of current pensions, which means a sacrifice of votes from the old citizens. These votes lost from old citizens must be compensated by votes gained from young citizens who expect larger next period pensions due to a larger pension fund. More formally, $A_{t+1}^A > 0$ implies that the ratio of marginal utilities in the left hand side of 22 equals $N_t p_{t+1}'\left(A_{t+1}^A\right)$. For this equality to hold $p_{t+1}'\left(A_{t+1}^A\right) > 0$, since marginal utilities are not negative (strictly positive if there is no satiation). Therefore, $p_{t+1}'\left(A_{t+1}^A\right) > 0$ is a necessary condition for a positive pension fund.

Equations 15 and 22 form a first-order difference equations system in $\left(A_t^A, p_t^A\right)$, with the initial condition $A_0 = 0$. An additional condition is needed to single out one path. The constraint that the pension fund is non negative is sufficient to rule out all but one path in the particular example that follows.

2.2.2 A fully specified example: logarithmic utility

With $u(c) = Ln(c)$, optimal old-age consumption is:

$$c_o(p_{t+1}) = \frac{\beta}{1+\beta} y_t \tag{23}$$

where y_t is the life-time income or wealth of generation t, evaluated in old age:

$$\begin{aligned} y_{-1} &= w(1+R) + p_0 \\ y_t &= (w-\tau)(1+R) + p_{t+1}(A_{t+1}) \quad , \quad t \geq 0 \end{aligned} \tag{24}$$

Generation -1 did not pay contributions to the pension system, because the system began in period 0, but they can still receive pensions.

It proves useful to rewrite the system in terms of the per capita pension fund ($a_t = A_t/N_t$) and citizens wealth (y_t). To this end, notice that:

$$\frac{dy_t}{dA_{t+1}^A} = p'_{t+1}\left(A_{t+1}^A\right) = \frac{1}{N_{t+1}} \frac{dy_t}{da_{t+1}^A} \quad , \quad t \geq 0 \tag{25}$$

23 and 25 in 22 yield:

$$\frac{y_t}{\beta y_{t-1}} \begin{cases} = \frac{y'_t\left(a_{t+1}^A\right)}{1+n} & , if \;\; a_{t+1}^A > 0 \\ \geq \frac{y'_t\left(a_{t+1}^A\right)}{1+n} & , if \;\; a_{t+1}^A = 0 \end{cases} \quad , \quad t \geq 0 \tag{26}$$

24 in 15:

$$\left(\frac{1+R}{1+n}\right) a_t - \frac{y_{t-1} - y_{t-1}^U}{(1+n)^2} = a_{t+1} \quad , \quad t \geq 0 \tag{27}$$

where:

$$\begin{aligned} y_{-1}^U &= (1+n)\tau + (1+R)w \\ y_t^U &= (1+n)\tau + (1+R)(w-\tau) \quad , \quad t \geq 0 \end{aligned} \tag{28}$$

is the citizens' life-time income when the pension system is unfunded.

Citizens and politicians have to guess the individuals wealth function, the function that maps next period pension fund into the citizens wealth:

$y_t\left(A_{t+1}\right)$. If agents do not make systematic mistakes, this function must prove ex-post correct. I show in the appendix that the right guess is:

$$y_t = Min\left\{ y_t^U + (1+n)(1+R)\,a_{t+1}, \frac{\sum_{i=0}^{\infty} y_{t+i}^U \left(\frac{1+n}{1+R}\right)^i + (1+n)(1+R)\,a_{t+1}}{1+\beta(1+n)} \right\}$$
$$t \geq -1 \tag{29}$$

Electoral competition reduces the rate at which the pension system transforms wealth of the old into wealth of the young citizens, benefitting the elderly and inducing the exhaustion of the pension fund. Without electoral competition, the administration of the pension system can withdraw one unit from the current pensions bill to give $(1+R)$ more units to next period pensioners. This *technical rate of transformation* is larger -and usually significantly so - than the *politically-determined rate of transformation,* which is the rate at which the political system transforms wealth of the old into wealth of the young citizens. Using 29 into 26:

$$\frac{y_t}{\beta y_{t-1}} = \frac{1+R}{1+\beta(1+n)} \tag{30}$$

The right hand side in 30 is the marginal rate of transformation of old citizens wealth into young citizens wealth in a politico-economic equilibrium with a positive pension fund. The *politically-determined rate of transformation* is a decreasing function of the discount factor and the rate of growth of the population. According to 29, the larger is $\beta(1+n)$ the smaller will be the share of an additional unit of the pension fund that the next administration will use to pay pensions to the currently young. Hence, the larger $\beta(1+n)$ the smaller the attention paid by young voters to pension issues, and the larger the incentive for politicians to please old voters paying better current pensions.

If the economy is dynamically *in*efficient $(R \leq n)$, the interior solution - the expression to the right of the comma in 29 - tends to infinite and the individuals wealth function is:

$$\begin{aligned} y_{-1} &= y_{-1}^U && , \quad if \;\; R \leq n \\ y_t &= y_t^U + (1+n)(1+R)\,a_{t+1} \quad , t \geq 0 && , \quad if \;\; R \leq n \end{aligned} \tag{31}$$

In a dynamically inefficient economy, political parties choose to exhaust the pension fund to offer old citizens the largest feasible pension. In each election, politicians are pushed by electoral competition to spend all the funds in pensions to the currently old voters. Equations 27 and 31 imply that $a_t = 0$ and $y_t = y_t^U$ for all $t \geq 0$. The pension system is completely unfunded from the beginning.

These results imply that electoral competition performs a Pareto improvement in a dynamically inefficient economy. The wealth citizens get before the introduction of the pension system is $w(1+R)$. With the unfunded pension system, citizens get y_t^U, which is larger than or equal to $w(1+R)$ if the economy is dynamically inefficient $(R \leq n)$. A fully funded pension system also yields $w(1+R)$. Hence, the unfunded system represents a Pareto improvement with respect to both the economy without pensions and the economy with a fully funded pension system, provided the economy is dynamically inefficient. It is well known that the unfunded pension system raises the utility of all generations if the economy without the pension system is dynamically inefficient. The news is that electoral competition induces politicians to spend the funds, improving the economic performance in a Pareto sense.

If the economy is dynamically efficient $(R > n)$, the individuals wealth function is, according to 29:

$$
\begin{aligned}
y_{-1} &= Min\left\{y_{-1}^U, \frac{w(1+R)^2}{(R-n)\left[1+\beta(1+n)\right]}\right\} \quad , \qquad if \quad R > n \\
y_t &= Min\left\{y_t^U + (1+n)(1+R)\,a_{t+1}, \frac{y_t^U\left(\frac{1+R}{R-n}\right) + (1+n)(1+R)\,a_{t+1}}{1+\beta(1+n)}\right\} \\
&\qquad , \, t \geq 0 \quad , \qquad if \quad R > n
\end{aligned}
\tag{32}
$$

The wealth of a generation has an upper bound given by the non-negativity constraint imposed on the pension fund. Members of generation t cannot expect to have a wealth larger than the expressions to the left of the comma in 32. This is the wealth they get if politicians in $t+1$ exhaust the pension fund: $a_{t+2} = 0$. These expressions characterize citizens' wealth in a corner solution of the political parties optimization program. Even if feasible, this wealth for generation t is not warranted. Politicians in $t+1$ may prefer to leave a positive pension fund $a_{t+2} > 0$ at the expense of a smaller pension p_{t+1} and a smaller wealth y_t. The expressions to the right of the comma in 32 represent the wealth that exactly balances the votes lost from young citizens and the votes gained from old citizens if one more unit of wealth is transferred from the young to the old citizens in $t \geq 0$. This is the value of y_t in an interior maximum of the parties optimization program.

Politicians still choose to exhaust the pension fund, if the interest rate is just slightly larger than the rate of growth of the population. The expressions to the right of the comma in 32 tend to infinite as $R \rightarrow n$, implying that citizens wealth is that of the unfunded pension system if the interest rate is close enough to the rate of growth of the population. In this case, the economy is dynamically efficient, and the unfunded pension system does not perform a Pareto improvement. The first generation still gains, but at the expense of all following generations. Old citizens in period zero get $y_{-1}^U = (1+n)\,\tau + (1+R)\,w$, which is obviously larger than the wealth citizens get before the introduction of the pension system $((1+R)\,w)$. The following generations get $y_t^U = (1+R)\,w - (R-n)\,\tau$, which is smaller, in a dynamically efficient economy, than the wealth they would have gotten if the unfunded pension system would have not been put in place.

The pension system builds a fund during period zero, if the interest rate is large enough. Equation 27 and the initial condition $a_0 = 0$ imply that $a_1 > 0$, iff $y_{-1} < y_{-1}^U$, which in turn holds true, according to 32, iff:

$$\frac{w\,(1+R)^2}{(R-n)\,[1+\beta\,(1+n)]} < y_{-1}^U \quad , \qquad \textit{and} \quad R > n \tag{33}$$

From 28 and 33, the necessary and sufficient condition for a positive fund in period 1 is:

$$\begin{aligned} f\,(R) &> 0 \quad , \quad \textit{where} \\ \frac{f\,(R)}{1+n} &= \beta\,(1+R)^2 - [1+\beta\,(1+n)]\left[\left(1-\frac{\tau}{w}\right)(1+R) + (1+n)\,\frac{\tau}{w}\right] \end{aligned} \tag{34}$$

The function $f\,(R)$ defines a continuous U-shaped curve. It is straightforward to show that $f\,(0) < 0$ and $f\,(n) < 0$. Hence, there is a positive $R^* > n$ such that the inequality 34 holds true for all $R > R^*$. This threshold is:

$$1 + R^* = \frac{1+\beta\,(1+n)}{2\beta}\left\{\left(1-\frac{\tau}{w}\right) + \left[\frac{\left(1-\frac{\tau}{w}\right)^2 + \beta\,(1+n)\left(1+\frac{\tau}{w}\right)^2}{1+\beta\,(1+n)}\right]^{\frac{1}{2}}\right\} \tag{35}$$

Having identified conditions for the existence of a positive pension fund at the beginning of period 1, the question arises about the ensuing dynamics. This example can be fully solved analytically, using the system of equations 27 and 32. Notwithstanding, the graphical analysis that follows is probably more informative in terms of the qualitative properties of the system.

The phase diagram The set of feasible (a_t, y_{t-1}) is the region in the positive quadrant consistent with the condition $a_{t+1} \geq 0$. From 27, this region is defined by:

$$y_{t-1} \leq (1+n)(1+R)\, a_t + y_{t-1}^U \quad , \quad 0 \leq y_{t-1},\, a_t \tag{36}$$

The locus of constant pension fund is, according to 27 :

$$y_{t-1} = (1+n)(R-n)\, a_t + y_{t-1}^U \tag{37}$$

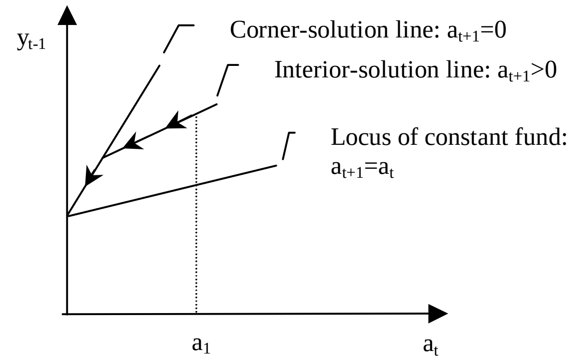
The pension fund is decreasing in the region above the straight line defined by 37, and it is increasing in the region below that line.

The equilibrium path describes a kinked curve formed by two straight lines that represent the interior and the corner solutions of the political parties optimization program. Equation 32 defines the equilibrium path (a_t, y_{t-1}) in a dynamically efficient economy. According to 32, the corner-solution line is steeper than the interior-solution line.

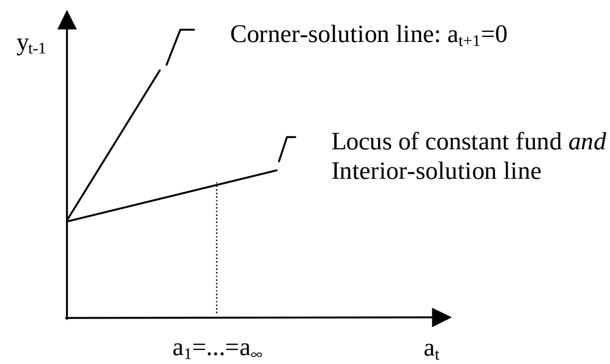
Three cases with qualitatively different dynamics can be identified, depending on the relative position and slope of the interior-solution line and the locus of constant pension fund. The first case represented in figure 1 occurs if $R^* < R < n + \frac{1}{\beta}$. With these parameter values, politicians leave a positive fund in the first period ($a_1 > 0$), but they reduce the fund in the following periods, eventually exhausting it. The wealth of individuals and pensions achieve a maximum with the first generation, those who are already old when the pension system is put in place, and reduce for the following generations. The second case occurs if $R = n+\frac{1}{\beta}$. The equilibrium pairs (a_t, y_{t-1}) lie on the locus of constant fund in this case, implying that the pension fund remains constant from period 1 onwards. The third case in figure 1 occurs if $n + \frac{1}{\beta} < R$. In these conditions, the pension fund increases period after period.

Insert figure 1

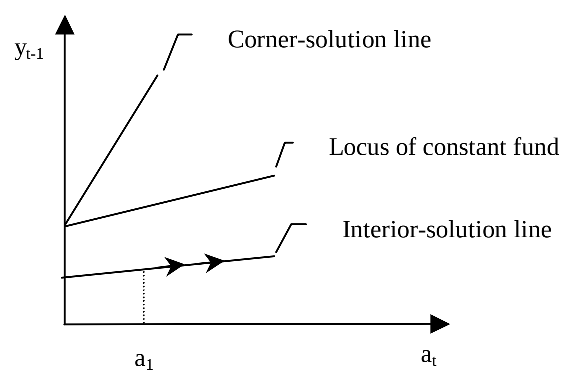
Figure 1: The dynamics of the pension fund and the wealth of citizens



First case: R*<R<n+1/β



Second case: R=n+1/β



Third case: R>n+1/β

Only the first of these three cases is consistent with complete consumption smoothing, since the necessary condition for complete consumption smoothing ($c_{ot+1}/c_{yt} = \beta(1+R) = 1$) implies that $R < n + \frac{1}{\beta}$. For the same reason, a consumption path tilted towards young age ($c_{ot+1}/c_{yt} = \beta(1+R) < 1$) is not consistent with the second and the third cases, i.e. with a politically sustainable pension fund. The second and the third cases cannot be ruled out, only if the economy exhibits a consumption path sufficiently tilted towards old age, i.e. if $c_{ot+1}/c_{yt} = \beta(1+R) >> 1$.

3 Concluding remarks

The model in this paper shows how electoral competition can push politicians to offer generous pensions, exhausting the pension fund. The first generation, those who are old during the early phase of the pension system, are the main beneficiaries of the transfers. In each election, old citizens are interested in current pensions and young citizens are interested in the fund that will allow higher pensions in the future. Even if young voters outnumber old voters, the politico-economic equilibrium is likely to favor old voters because they tend to be more willing to change their vote for a good pension than are young voters to change their vote for a larger pension fund. This different responsiveness makes old citizens a good target for electoral-motivated transfers in social security.

According to the model in this paper, old citizens are likely to be more responsive than young citizens to transfers channeled through the pension system because politicians are usually better equipped to benefit the old than the young citizens. Politicians can commit -and therefore include in their electoral platforms- pensions to be granted to old citizens after the elections. But they do not have the same ability to commit future pensions to the currently young citizens, for those pensions will be set after the following elections. Politicians can commit to leave a pension fund to woo young voters, but this offer basically defeats itself. Indeed, young citizens may be interested in preserving the pension fund, but only to spend it in the next period. However, if they succeed in preserving the fund today, they should expect that the following generation will also succeed in preserving the fund tomorrow, preventing them from enjoying the benefits of larger pensions. Therefore, young voters mild interest in the pension fund is not likely to be an effective device to "discipline" politicians to keep the pension fund alive.

4 Appendix

The expression 29 is a correct guess for the wealth function when utility is logarithmic, because this function represents the actual relationship between the pension fund and the individuals wealth in a politico-economic equilibrium in t, if agents expect this function to hold in $t+1$. Consider first the interior solution, and suppose that in t politicians expect that y_{t+1} will be:

$$y_{t+1} = \frac{\sum_{i=0}^{\infty} y_{t+1+i}^{U} \left(\frac{1+n}{1+R}\right)^{i} + (1+n)(1+R)\, a_{t+2}}{1+\beta(1+n)} \tag{38}$$

From 26:

$$\frac{y_{t+1}}{\beta y_t} = \frac{y_{t+1}'(a_{t+2})}{1+n} \tag{39}$$

From 38 and 39:

$$y_t = \frac{(1+n)\, y_{t+1}}{\beta y_{t+1}'(a_{t+2})} = \frac{\sum_{i=0}^{\infty} y_{t+1+i}^{U} \left(\frac{1+n}{1+R}\right)^{i} + (1+n)(1+R)\, a_{t+2}}{\beta(1+R)} \tag{40}$$

From 27 and 40:

$$y_t = \frac{\sum_{i=0}^{\infty} y_{t+1+i}^{U} \left(\frac{1+n}{1+R}\right)^{i} + y_t^{U}\left(\frac{1+R}{1+n}\right) + (1+R)^2 a_{t+1} - y_t\left(\frac{1+R}{1+n}\right)}{\beta(1+R)} \tag{41}$$

and reorganizing terms:

$$y_t = \frac{\sum_{i=0}^{\infty} y_{t+i}^{U} \left(\frac{1+n}{1+R}\right)^{i} + (1+n)(1+R)\, a_{t+1}}{1+\beta(1+n)} \tag{42}$$

The constraint $a_{t+2} \geq 0$ and 27 imply:

$$y_t \leq y_t^{U} + (1+n)(1+R)\, a_{t+1} \tag{43}$$

Hence y_t must be the minimum between the right hand side expressions in 42 and 43 and equation 29 follows.

References

Alesina, A. (2000): "The Political Economy of the Budget Surplus in the United States," *Journal of Economic Perspectives*, 14(3), 3–19.

Boadway, R. W., and D. E. Wildasin (1989): "A Median Voter Model of Social Security," *International Economic Review*, 30(2), 307–329.

Browning, E. (1975): "Why the Social Insurance Budget is Too Large in a Democracy," *Economic Inquiry*, 13, 373–388.

Casamatta, G., H. Cremer, and P. Pestieau (1998): "The Political Economy of Social Security Reform," Working Paper, Toulouse, CORE and DELTA.

Diamond, P. (1999): *Issues in Privatizing Social Security: Report on an Expert Panel of the National Academy of Social Insurance.* The MIT Press, Cambridge, Massachusetts.

Disney, R. (1996): *Can We Afford to Grow Older? A Perspective on the Economics of Aging.* The MIT Press, Cambridge, Massachusetts.

Dixit, A., and J. Londregan (1996): "The determinants of success of special interests in redistributive politics," *Journal of Politics*, 58, 1132–1155.

Fudenberg, D., and J. Tirole (1992): *Game Theory.* The MIT Press.

Hu, S. (1982): "Social Security, Majority-Voting Equilibrium and Dynamic Efficiency," *International Economic Review*, 23(2), 269–287.

Lindbeck, A., and J. Weibull (1993): "A model of political equilibrium in a representative democracy," *Journal of Public Economics*, 51(2), 195–209.

Lindbeck, A., and J. W. Weibull (1987): "Balanced-budget redistribution as the outcome of political competition," *Public Choice*, 52, 273–297.

Mesa-Lago, C., and F. Bertranou (1998): *Manual de Economía de la Seguridad Social.* CLAEH, Uruguay.

Mulligan, C., and X. Sala-i-Martin (1999): "Social Security in Theory and Practice (I): Facts and Political Theories," Working Paper No 7118, NBER.

Mulligan, C. B. (2000): "Review of: Funding Social Security: A strategic alternative," *Journal of Economic Literature*, 38(3), 659–660.

Munnell, A. (1998): "The Great Surplus Debate: Save It," *The American Spectator*, pp. 80–83.

Persson, T., and G. Tabellini (2000): *Political Economics. Explaining Economic Policy.* The MIT Press.

Tabellini, G. (1991): "The Politics of Intergenerational Redistribution," *Journal of Political Economy*, 99(2), 335–357.

Tullock, G. (1998): *On voting: A public choice approach.* Cheltenham, U.K.: Edward Elgar.

World Bank (1994): *Averting the Old Age Crisis.* Oxford University Press.