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Abstract

Most public pension systems failed to build trust funds, even when it was clear that they were becoming unsustainable in the long run. It is argued in this paper that politicians ruling public pension programs have strong incentives to exhaust the trust funds, distributing benefits among voters to raise their probability of winning elections. Old citizens are among the most responsive voters to pensionary benefits and are thus the likely beneficiaries in this redistributive game. Within each generation, poor voters are more responsive to pensionary benefits than rich voters, and are therefore good targets for redistributive politics as well. Simulation results suggest that these policies may significantly dampen aggregate savings.

Keywords: Electoral Competition, Pensions, Political Clients, Probabilistic Voting.

JEL: E690, H550

1 Introduction

Most public pension systems failed to build trust 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 trust funds in periods in which the pension bill is known to be temporary low in order to finance pensions when the retirees-contributors ratio become 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 of the failure of public pension systems to accumulate funds. The main hypothesis is that politicians have exhausted the pension funds, distributing benefits among voters 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 transfers in the pension system. Politicians are able to commit transfers offered to individuals during the electoral campaign, implying that voters take these offers into account to decide their vote.[1] By the very nature of the pension system, the benefits that candidates can most easily offer in connection with this part of the public administration are transfers to the currently old citizens.

The candidates allocate transfers to those voters that are more responsive in terms of voting.These transfers cause intra and intergenerational redistribution. Other things equal, benefits offered in exchange for votes favor poor segments of the population. Politicians engaged in electoral competition channel transfers towards poor citizens because necessity makes their votes more responsive to economic benefits (Lindbeck and Weibull 1987, Dixit and Londregan 1996). Electoral competition also favors the first generations, those who are old in the early phases of the pension system, at the expense

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[1]The commitment assumption is less demanding with office-motivated politicians than with ideological ones, for the former only care about winning elections, and have no particular interest in doing after elections anything different from what they offered before elections.

of the following generations. Electoral competition compells politicians to use the proceeds of social security contributions to 'buy' votes, instead of raising a pension fund that might eventually be used by their electoral competitors. Therefore, the pension system turns into a pay-as-you-go system, with its well know property of redistributing income in favor of the first generations. Furthermore, being unfunding an unintended outcome of a short-run redistributive process, there is no warranty that the emerging pay-as-you-go system is sustainable in the long run.

This theory is consistent with the evolution of actual institutions in many countries. Most public pension systems are currently fully unfunded, but were not initially intended to be so. Inspired in the Bismarckian paradigm, the provident funds aimed at providing old-age insurance. Individual pensions were only loosely dependent on individual lifetime contributions. By pooling the contributions of many workers, the provident funds reduced the individual risk exposure. Intergenerational redistribution was very limited by current standards. Later on, however, most pension systems evolved to pay-as-you-go (PAYG). One way or another, accumulated reserves were eroded (Disney,1996, p 59; World Bank,1994). 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.

Fears of political missuse 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). 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.

The existing literature presents several positive theories aimed at explaining why public social security exists. In a recent survey, Mulligan and Sala-i-Martin (1999a and b) classified these theories in two broad categories: *political* and *efficiency theories.* The former emphasize redistribution and

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political struggle in social security, while the latter see social security as an institution designed to alleviate market failures. The model in this paper does not explain why public pension systems are put in place. In this respect, the present paper rests on existing theories, mainly on efficiency theories. The view behind this paper is that social security programs were put in place and supported by the population because these programs help to alleviate market failures and to perform some redistribution that most citizens consider socially desirable. The aim of this paper is rather to explain why many social security systems performed so badly.

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). A crucial assumption in these models is that the policy is one-dimensional. The policy variable is a flat payroll tax rate that finances pensions paid to the currently old. With these assumptions, the median voter result holds, i.e. the equilibrium tax rate is the tax preferred by the median voter. Apart from analytical tractability, the use of majority voting to model social security and other broad redistributive programs has been justified on the grounds that in these programs the disagreement among the voters is aligned on a single dimension (Persson and Tabellini 2000, p 117). However, the redistribution taking place through social security programs involves many particularistic and highly targeted transfers that are not apropriately captured in a model that imposes one-dimensional redistribution. Accordingly, the present paper proposes a model of probabilistic voting that puts in the center of the scene the competition among politicians to please particular groups of voters offering differentiated benefits.

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).

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The assumption of a direct vote for the pay-as-you-go pension system (PAYG) 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 (1999b), 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 are not free from 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 unbacked benefits to old citizens. But this offer is difficult to monitor, and only loosely related to individual transfers in the far future. 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. This idea is formally captured in the model in this paper assuming that each citizen observes only his own transfer. Therefore, politicians cannot credibly announce not to grant benefits to the currently old, and young voters do not decide their vote on these grounds.

Majority voting theories have been the most popular among the political theories of social security, but they are not the only ones. Mulligan and Sala-i-Martin (1999a) present a model of lobbying in social security. They argue that lobbying is a time consuming activity. Old citizens have more free time than other groups in society, and hence tend to be more successful in the

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redistributive struggle. The probabilistic voting model in the present paper shares with the lobbying model the view that there is much particularistic redistribution going through social security. The driving forces behind the redistribution process in these two theories are quite different, but they certainly do not exclude each other. Rather lobbying and electoral competition are complementary hypotheses that contribute to explain the redistributive process taking place in the social security system.

Benefits used in redistributive politics show in many different disguises. Pensions granted to workers who did not contribute in the past, special benefits for particular groups of workers, and early retirement for unemployees are just some examples. The details seem to depend much on institutional arrangements that are country specific. The model in this paper is directly inspired by the experience of some Latin American countries, in which informality, loose controls, evasion and low coverage are pervasive phenomena in social security. But the general point that the redistribution taking place through the pension system is more particularistic than what the majority voting model assumes extends to other regions and realities. For instance, referring to European pension programs, Boldrin, Dolado, Jimeno, and Peracchi (2000) say that "Their use as camouflaged redistributional devices, motivated by rent-seeking and political purposes, has turned into an abuse, and, in about three decades, almost lead to their financial bankruptcy."

2 The model

2.1 Description of the society

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 $(c_{y,t})$, young age savings (s_t), and "formalization" (F_t). He may contribute to social security $(F_t = 1)$, paying when he is active a social security contribution τw and receiving the flat pension p when he is old. Alternatively, the worker may stay in the informal sector $(F_t = 0)$, not contributing to social security, not receiving the pension p, and incurring in a cost εw, with $\varepsilon \in [0, 1)$. The cost of informality ε is designed to capture several effects, like the intrinsically lower productivity that can be achieved in the informal

sector, the costs of evading (the energy spent in creative accounting, for instance), and the fine that an evader may have to pay if he is captured. In period t+1, citizens who were born in t are old and consume $(c_{o,t+1})$.

Citizens vote twice in their lifespan, the first time when they are young and the second when they are old. In each election, they vote for one of two political parties, party A and party B.

Members of this society have political as well as economic preferences. Total utility of a member of generation t is:

$$u\left(c_{y,t}\right) + D_t\left(\sigma + \delta\right) + \beta\left[u\left(c_{o,t+1}\right) + D_{t+1}\left(\sigma + \delta\right)\right] \tag{1}$$

where $D_t = 0$, if party A is in office, and $D_t = 1$, otherwise. The utility functions $u(.)$ are concave and Inada conditions hold. Political preferences for party B relative to party 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.

Citizens differ in the wages they earn, because of intrinsic differences in labor efficiency (e), and in their individual-specific political preferences. The distribution of these individual characteristics in the population is represented by the following continuous cumulative distribution function: $H\left(w,\sigma\right)$.[2] In the present version of the model, the distribution of wages is assumed to be independent of the distribution of political preferences. Hence the joint density is the product of the marginal densities:

$$h\left(w,\sigma\right) = h_w\left(w\right) h_\sigma\left(\sigma\right) \tag{2}$$

The pension system is ruled by politicians who use pension funds to give patronage benefits to old citizens in exchange for votes. Politicians belong to either party A or party B. They do not observe political preferences of the population, but they know that the individual-specific political preferences are distributed according to function 2 and that the whole-population parameter is a realization of a random variable with cumulative distribution function $\Delta\left(\delta\right)$. Politicians observe individual wage, consumption, savings and formalization. This information structure allows political parties to make patronage benefits contingent on wages, but not on individual political preferences. The assumption of independence (equation 2) implys that

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[2]The individual wage in this model is a function of the individual labor efficiency. Hence the distribution function over labor efficiency implys a distribution function over wages.

wages are uninformative about political preferences. A period-t retiree who earned wage w when he was active receives a patronage benefit $b_t^G(w)$ if party $G \in \{A, B\}$ is in office. Politicians announce benefits to be granted to retired citizens before elections.

The contribution rate (τ) and the pension (p) are settled in the pension law. Unlike patronage benefits which are discretional and targeted to particular constituencies ("tailor made" benefits), the contribution rate and the pension are structural parameters, costly to modify and less targeted to particular groups. The model in this paper takes these two structural parameters as given and aims at explaining the discretionary transfers. The only constraint put on the contribution rate and the pension is that the system must be sustainable in the long run.

There is a large number of competitive firms that produce a unique good using labor and capital (K_t). The firm may hire workers with different efficiency. Let L_t^e be the number of workers with efficiency e in the firm's labor force in period t. Output (Y_t) depends on total units of efficient-labor employed in the firm (E_t). Labor services of workers with different intrinsic efficiency are perfect substitutes:

$$Y_t = Y(K_t, E_t) \ , \ E_t = \int e L_t^e de \qquad (3)$$

The production function exhibits constant returns to scale. Firms choose capital and labor to maximize benefits.

The economy is fully open to trade and to financial flows. Capital moves freely and costlessly across frontiers. Markets are perfectly competitive and the country is small, implying that domestic events do not affect the price of the good, or the interest rate (r). Citizens stay in their home country. They can send their savings abroad, but they cannot work abroad or vote in a foreign country.

The timing is as follows: a) Political parties choose their electoral platforms $\left(b_t^A(w), b_t^B(w)\right)$ at the beginning of each period. Politicians know individual income, and the distribution of political preferences in the population, but they do not observe individual political preferences. b) Elections take place. Each voter knows the transfer that political parties offered him, but not the transfers offered to other citizens, i.e. transfers are private information. c) Firms produce. Young workers consume, save and decide whether to contribute to social security. Old workers consume. These steps are repeated in each period.

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2.2 The politico-economic equilibrium

Definition 1 *a politico-economic equilibrium is a situation such that: a) politicians choose benefits to maximize their probability of winning the elections; b) politicians correctly anticipate the amount of contributions to social security; c) citizens choose their vote, consumption, savings and formalization that maximize their expected utilities; c) citizens correctly anticipate the amount of benefits one period ahead.*

The solution strategy is backward induction, save for young-citizens economic decisions that are analyzed after elections. Young citizens do not have much a stake in the current elections in terms of transfers, and hence it is possible to analyze the electoral process before going into the details of their economic behavior. In turn, a thorough understanding of electoral competition is crucial for the analysis of young agents economic decisions.

2.2.1 Old citizens choose consumption

Citizens consume all their resources during their second and last period of life. Hence, old-age consumption is:

$$c_{o,t}^{G}(w) = s_{y,t-1}(w) R + pF_{t-1}(w) + b_{t}^{G}(w) \quad , \quad G \in \{A, B\} \tag{4}$$

where R stands for the gross interest rate $(R = 1 + r)$, and it has been made explicit that consumption, savings and formalization are functions of wages. At this stage, all variables on the right-hand side of equation 4 are given.

2.2.2 Firms hire labor and capital

Firms maximize benefits setting marginal product of production factors equal to their returns:

$$\frac{\partial Y}{\partial K}(K_t, E_t) = r = R - 1 \tag{5}$$

$$\frac{\partial Y}{\partial L^e}(K_t, E_t) = \frac{\partial Y}{\partial E}(K_t, E_t) e = w(e) \tag{6}$$

The economy is open to capital flows. Capital markets are perfectly competitive and hence the domestic interest rate is equal to the world interest rate. In turn, equation 5 and the assumption of constant returns to scale imply

that the ratio of capital to efficient labor hired by domestic firms (K/E) is a function of the interest rate. Finally, this capital-labor ratio substituted in the equations 6 (one for each e) determine the wages firms are willing to pay to workers with efficiency e. In this setting, the domestic social security system does not affect neither the interest rate nor the cost of labor for firms (w). Contributions to social security only reduce workers' disposable income: $w(1-\tau)$.

2.2.3 Elections

Young citizens decide their votes based only on their political preferences. They do not benefit from transfers distributed by politicians elected in the current election. These transfers go to the currently old citizens. Young citizens may still care about patronage benefits, since these transfers erode the pension fund, and will eventually damage them. Nevertheless, young citizens are not willing to reward politicians that promise to abstein from distributing patronage benefits because they do not know individual transfers and cannot verify that this promise is honored. Hence, young citizens with individual-specific political preferences $\sigma < -\delta$ vote for party A. The number of votes for party A among them is:

$$V_{y,t}^A = N_t H_\sigma (-\delta) \tag{7}$$

Old citizens consider political preferences and patronage benefits in deciding their votes. An old citizen is indifferent between party A and party B, if his political preference is such that:

$$\sigma(w,\delta) = u\left(c_{o,t}^A(w)\right) - u\left(c_{o,t}^B(w)\right) - \delta \tag{8}$$

where $c_{o,t}^A(w)$ is old-age consumption of a worker who earned wage w, if party A is in office (analogous for party B).

The number of old citizens who vote for party A is:

$$
\begin{aligned}
V_{o,t}^A &= N_{t-1} \int_{w \in W} \left\{ \int_{\sigma < \sigma(w,\delta)} h(\sigma \mid w) \, d\sigma \right\} h_w(w) \, dw = \\
&= N_{t-1} \int_{w \in W} H(\sigma(w,\delta) \mid w) \, h_w(w) \, dw \tag{9}
\end{aligned}
$$

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The assumption that political preferences and wages are independently distributed (equation 2) implys that:

$$
\begin{aligned}
V_{o,t}^A &= N_{t-1} \int_{w \in W} H_\sigma \left(\sigma \left(w, \delta \right) \right) h_w \left(w \right) dw = \\
&= N_{t-1} \int_{w \in W} H_\sigma \left(u \left(c_{o,t}^A \left(w \right) \right) - u \left(c_{o,t}^B \left(w \right) \right) - \delta \right) h_w \left(w \right) dw \quad (10)
\end{aligned}
$$

The number of votes for party A $\left(V_{y,t}^A + V_{o,t}^A \right)$ is a non-increasing function of δ:

$$
\frac{dV_{y,t}^A}{d\delta} = -N_t h_\sigma \left(-\delta \right) \le 0 \tag{11}
$$

$$
\frac{dV_{o,t}^A}{d\delta} = -N_{t-1} \int_{w \in W} h_\sigma \left(\sigma \left(w, \delta \right) \right) h_w \left(w \right) dw \le 0 \tag{12}
$$

Hence, party A wins the election if δ is lower than the threshold δ^* implicitly defined by :

$$
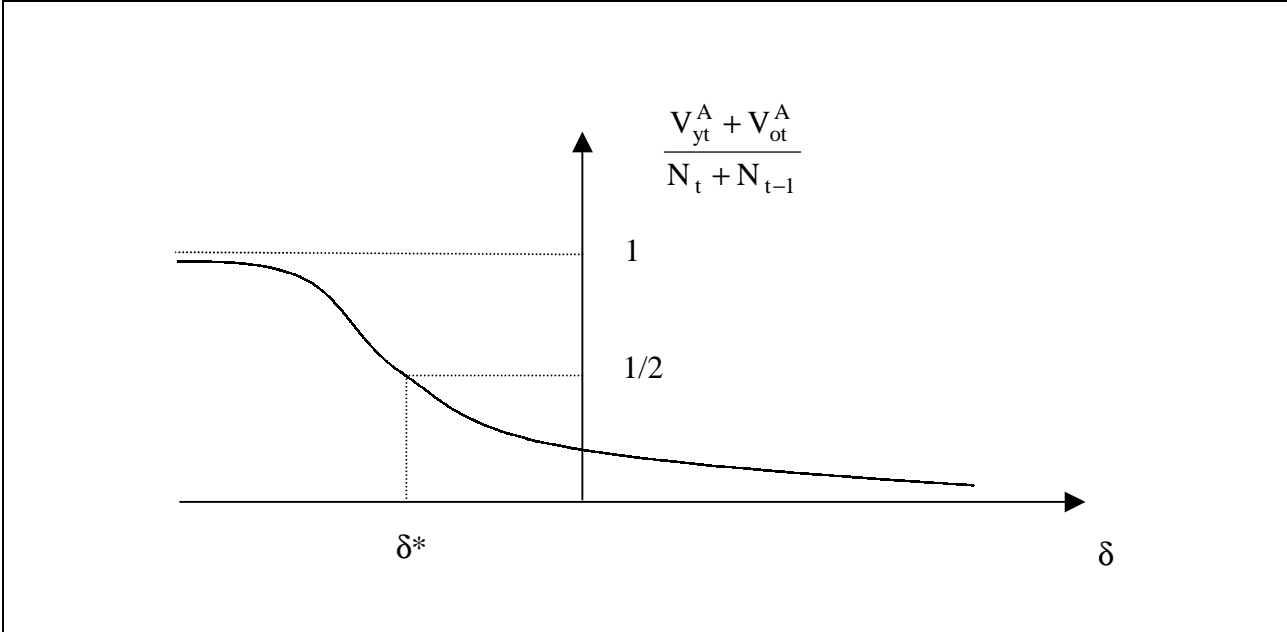\frac{V_{y,t}^A + V_{o,t}^A}{N_t + N_{t-1}} = \frac{1}{2} \tag{13}
$$

or, using 7 and 10 in 13:

$$
N_t H_\sigma \left(-\delta^* \right) + N_{t-1} \int_{w \in W} H_\sigma \left(\sigma \left(w, \delta^* \right) \right) h_w \left(w \right) dw = \frac{N_t + N_{t-1}}{2} \tag{14}
$$

The probability that party A wins the election is $\Delta \left(\delta^* \right)$.

<div align="center">Insert Figure 1</div>

2.2.4 Politicians choose "electoral platforms"

Political parties simultaneously choose patronage benefits to maximize their probability of winning the election. Party A, in particular, solves the follow-

<div align="center">11</div>

ing program:

$$\underset{b_t^A(w),\delta^*}{Maximize} \ \Delta\left(\delta^*\right) \tag{15}$$

$$s.t.: \quad Equation \ 14$$

$$N_{t-1}\int\limits_{w\in W}\left[pF_{t-1}\left(w\right)+b_t^A\left(w\right)\right]h_w\left(w\right)dw \leq N_t\int\limits_{w\in W}\tau wF_t\left(w\right)h_w\left(w\right)dw \tag{16}$$

$$0 \leq b_t^A\left(w\right) \tag{17}$$

The expression 16 is a resources constraint. It is assumed that the government can only distribute the funds it raises each period. The assumption of balanced budget may look restrictive, but the general point is that the funds to be distributed are limited. Politicians must decide how to administer this scarcity.

The expressions 17 are the conditions that patronage transfers are non-negative, no matter the wage level of the citizens. Setting negative individual transfers on a discretionary basis would not be admmisible in most countries, for it would vulnerate a crucial constitutional principle of equal individual treatment by the authorities. Provision of positive discretionary transfers also imply an outright violation of the same constitutional principle, but the many citizens that are not benefited have strong incentives to free ride on the civil actions needed to preserve this principle.

Let L be the Lagrangian of this program, λ_1 and λ_2 the multipliers of the constraints 14 and 16, and $\mu\left(w\right)$ the multipliers of the constraints 17. Using

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equations 4 and 8, the first order conditions can be written as follows:

$$\frac{\partial L}{\partial b_t^A(w)} = \left[\lambda_1 h_\sigma\left(\sigma\left(w,\delta^*\right)\right) u'\left(c_{o,t}^A\right) - \lambda_2\right] N_{t-1} h_w(w) + \mu(w) = 0;$$
$$w \in W \tag{18}$$

$$\frac{\partial L}{\partial \delta^*} = \Delta'\left(\delta^*\right) - \lambda_1 N_t h_\sigma\left(-\delta^*\right) -$$
$$-\lambda_1 N_{t-1} \int_{w \in W} h_\sigma\left(\sigma\left(w,\delta^*\right)\right) h_w(w)\, dw = 0 \tag{19}$$

$$\frac{\partial L}{\partial \lambda_1} = N_t H_\sigma\left(-\delta^*\right) + N_{t-1} \int_{w \in W} H_\sigma\left(\sigma\left(w,\delta^*\right)\right) h_w(w)\, dw -$$
$$-\frac{N_t + N_{t-1}}{2} = 0 \tag{20}$$

$$\frac{\partial L}{\partial \lambda_2} = N_t \int_{w \in W} \tau w F_t(w) h_w(w)\, dw -$$
$$-N_{t-1} \int_{w \in W} \left[p F_{t-1}(w) + b_t^A(w)\right] h_w(w)\, dw = 0 \tag{21}$$

$$\frac{\partial L}{\partial \mu(w)} \mu(w) = b_t^A(w) \mu(w) = 0 \quad ; \quad \mu(w) \geq 0 \quad ; \quad w \in W \tag{22}$$

Equations 18 and 22 imply that old citizens who benefit from patronage transfers reach a consumption level that satisfies:

$$\lambda_1 h_\sigma\left(u\left(c_{o,t}^A(w)\right) - u\left(c_{o,t}^B(w)\right) - \delta^*\right) u'\left(c_{o,t}^A(w)\right) = \lambda_2 \; ; \; w \in W_{t-1}^A \tag{23}$$

where W_{t-1}^A is the set of wages earned in period t-1 by citizens who benefit from party A's transfers in period t.

Given the symmetry of the model, it is just natural to focus on a symmetric Nash equilibrium in which both parties offer the same transfers, and citizens get the same consumption with both parties. In this type of equilibrium, equation 23 simplifies to:

$$\lambda_1 h_\sigma\left(-\delta^*\right) u'\left(c_{o,t}\right) = \lambda_2 \quad ; \quad w \in W_{t-1}^G \quad ; \quad G \in \{A, B\} \tag{24}$$

According to equation 24, all citizens who receive patronage benefits enjoy the same level of old-age consumption $(c_{o,t})$ in a symmetric Nash equilibrium.

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This consumption level does not depend on individual wage, savings or "formalization". It does not depend on which party wins the election either.

The beneficiaries of patronage transfers are citizens who cannot afford consumption $c_{o,t}$ by their own. They receive positive transfers $b_t(w) > 0$ to reach the consumption $c_{o,t}$. Old citizens who can afford larger consumption do not receive transfers. These observations follow immediately from substituting $c_{o,t}$ and $b_t(w)$ for $c_{o,t}^G(w)$ and $b_t^G(w)$ in equation 4:

$$b_t(w) = \begin{cases} c_{o,t} - [s_{y,t-1}(w)R + pF_{t-1}(w)] > 0 & ; & w \in W_{t-1}^G \\ 0 & ; & w \notin W_{t-1}^G \end{cases} \qquad (25)$$

The consumption targeted by political parties to beneficiaries of transfers is determined substituting the benefits $b_t(w)$ computed in equations 25 into the resources constraint (equation 21):

$$c_{o,t} = \frac{\int\limits_{w \in W_{t-1}^G} s_{y,t-1}(w)Rh_w(w)\,dw - \int\limits_{w \notin W_{t-1}^G} pF_{t-1}(w)h_w(w)\,dw}{\int\limits_{w \in W_{t-1}^G} h_w(w)\,dw} +$$

$$+ \frac{N_t \int\limits_{w \in W} \tau w F_t(w) h_w(w)\,dw}{N_{t-1} \int\limits_{w \in W_{t-1}^G} h_w(w)\,dw} \qquad (26)$$

The Kuhn-Tucker multiplier $\mu(w)$ is positive for citizens who do not receive patronage benefits. Using this condition in equation 18, and focusing again on symmetric Nash equilibria:

$$\lambda_1 h_\sigma(-\delta^*)u'(c_{o,t}(w)) = \lambda_2 - \frac{\mu(w)}{N_{t-1}h_w(w)} < \lambda_2 \quad ; \quad w \notin W_{t-1}^G \qquad (27)$$

Old citizens who do not receive patronage benefits have their consumption depending on their individual wages. Nevertheless, all members of this group enjoy higher old-age consumption than beneficiaries of patronage benefits (equations 24 and 27). Therefore, electoral competition based on patronage benefits is "progressive": office-motivated politicians channel resources towards poor citizens.

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2.2.5 Young citizens choose consumption, savings and formalization

Young citizens know how the political system works. Members of generation t know that beneficiaries of patronage transfers will enjoy the same consumption level (equation 24 holds for period t+1 as well). They also know that they can make themselves elegible for patronage benefits – i.e. to become political "clients"– by choosing to evade contributions to social security and/or choosing low enough savings (equation 25). Moreover, an individual that decides to make himself elegible for patronage benefits will not only evade contributions, but he will also choose young-age savings as small as possible. His young-age consumption is decreasing, and his old-age consumption will not be increasing, in contributions to social security and young-age savings. Were they allowed, young citizens who plan to live out of patronage benefits during their old age would choose infinitely negative savings, i.e. infinite large debt, and enjoy infinite consumption during their first period of life. However, such behavior would rest on an unbelievable degree of enforceability of credit contracts. Young citizens who engaged in such levels of indebtedness would hardly be hold responsible for most of the debt, particularly for that part that can only be paid counting on patronage benefits. Therefore, lenders would not be willing to lend that much, and citizens would be credit rationed. Accordingly, it is assumed in this paper that young citizens cannot borrow on either pensions or patronage benefits, implying that young-age savings must be non negative. [3] Given this credit constraint, young citizens who decide to rest on patronage benefits for their old-age living choose zero savings and evade contributions to social security:

$$s_{y,t}(w) = F_t(w) = 0 \quad ; \quad w \in W_t^G \tag{28}$$

These citizens consume their wage, when they are young, and the patronage benefit, when they are old:

$$c_{y,t}(w) = w(1 - \varepsilon) \tag{29}$$

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[3]The assumption that agents cannot borrow on pensions is quite standard. In the present setting, this is not a crucial assumption: the qualitative results do not change if borrowing on pensions is allowed. What is crucial is that borrowing on patronage benefits is not allowed. This does not look as a very demanding assumption, for political parties engaged in electoral competition do not care about the well being of lenders, who are not their political "clients", and have no incentives to enforce credit contracts to that extent.

$$c_{o,t+1}(w) = b_{t+1}(w) \quad ; \quad w \in W_t^G \tag{30}$$

Old-age consumption is uniform across political "clients"(equation 24), implying that patronage benefits are uniform as well:

$$b_{t+1} = b_{t+1}(w) = c_{o,t+1}(w) = c_{o,t+1} \quad ; \quad w \in W_t^G \tag{31}$$

Life time (economic) utility of a beneficiary of patronage benefits who was born in period t is:

$$U_t^{Client}(w) = u\left(w\left(1 - \varepsilon\right)\right) + \beta E u\left(b_{t+1}\right) \quad ; \quad w \in W_t^G \tag{32}$$

Citizens can decide not to become political "clients", choosing positive savings or contributing to social security when they are young. A young citizen who decides not to make himself elegible for patronage benefits solves the following program:

$$
\begin{aligned}
&\underset{c_{y,t},\, c_{o,t+1},\, F_t}{Maximize} \quad && u\left(c_{y,t}\right) + \beta u\left(c_{o,t+1}\right) \\
&\quad s.t. : \quad && c_{y,t} + s_{y,t} \leq \left(1 - \tau F_t\right) w - \left(1 - F_t\right) \varepsilon w \\
& && c_{o,t+1} \leq R s_{y,t} + p F_t \\
& && 0 \leq s_{y,t} \\
& && F_t \in \{0,1\}
\end{aligned}
\tag{33}
$$

Non beneficiaries of patronage transfers must decide whether to contribute or not to social security. Call the first group "contributors" and the second group "non-client evaders". The life-time (economic) utiliy of a "contributor" is:

$$U_t^{Cont}(w) = u\left(c_{y,t}(w,1)\right) + \beta u\left(c_{o,t+1}(w,1)\right) \tag{34}$$

where $c_{y,t}(w,1)$ and $c_{o,t+1}(w,1)$ are the young and old-age consumption that maximize utility of an individual with wage w, given that he chose to contribute to social security. In other words, $c_{y,t}(w,1)$ and $c_{o,t+1}(w,1)$ are the solutions to program 33, if $F_t = 1$ The life-time (economic) utility of a "non-client evader" is:

$$U_t^{NcE}(w) = u\left(c_{y,t}(w,0)\right) + \beta u\left(c_{o,t+1}(w,0)\right) \tag{35}$$

where $c_{y,t}(w,0)$ and $c_{o,t+1}(w,0)$ are the young and old-age consumption that maximize utility of an individual with wage w, given that he chose *not* to

contribute to social security and not to be a beneficiary of patronage transfers.

Young citizens compare the life-time (economic) utilities depicted in equations 32, 34 and 35, and decide whether they prefer to be "political clients", contributors to social security or non-client evaders. Utilities of contributors and non-client evaders can be directly computed with the available information.But the expected utility of "clients" in perid t depends on patronage benefits to be determined one period ahead. Notwithsanding, citizens know that period-t+1 benefits depend on expected patronage benefits for periods t+1 and t+2. The larger the expected patronage benefit for period t+1 $\left(b_{t+1}^e\right)$, the larger the number of "clients", and the smaller the amount of pensions due in period t+1. The larger the expected patronage benefit for period t+2 $\left(b_{t+2}^e\right)$, the smaller the amount of contributions collected in period t+1. More formally, patronage benefits paid in period t+1 can be determined using equations 26, 28 and 30 to get:

$$
\begin{aligned}
b_{t+1} &= b_{t+1}\left(b_{t+1}^e, b_{t+2}^e\right) = \\
&= \frac{\int\limits_{w \in W} \left[(1 + n_{t+1})\tau w F_{t+1}\left(w, b_{t+2}^e\right) - p F_t\left(w, b_{t+1}^e\right)\right] h_w(w)\,dw}{\int\limits_{w \in W_t^G} h_w(w)\,dw}
\end{aligned}
\tag{36}
$$

$$
W_t^G : \left\{w \left| U_t^{Client}\left(w, b_{t+1}^e\right) > U_t^{Cont}(w)\,;\ U_t^{Client}\left(w, b_{t+1}^e\right) > U_t^{NcE}(w)\right.\right\}
$$

where n_{t+1} is the rate of growth of the population between t and t+1, and $F_t\left(w, b_{t+1}^e\right)$ is the optimal "formalization" decision in period t of a young citizen who earns wage w and expects a patronage benefit for the following period b_{t+1}^e. The expected patronage benefits must be equal to the actual patronage benefits in a politico-economic equilibrium. Therefore, in an equilibrium, equation 36 imply that patronage benefits in one period depends on patronage benefits in the following period.

In a steady state, benefits remain constant one period after the other. Hence, citizens can compute the amount of patronage benefits in the steady

state (b), using equation 36:

$$b = \frac{\int\limits_{w \in W} (\tau w (1 + n) - p) F(w, b) h_w(w) \, dw}{\int\limits_{w \in W^G} h_w(w) \, dw} \tag{37}$$

$$W^G = \left\{ w \left| U^{Client}(w, b) > U^{Cont}(w) \ \ and \ U^{Client}(w, b) > U^{NcE}(w) \right. \right\}$$

The politico-economic equilibrium path can be computed using the following iterative procedure:

A) Computing the Steady State

A.1) Make an initial guess for patronage benefits to be granted in the steady state.

A.2) Compute the life time (economic) utilities of all young citizens, and determine which citizens will belong to each of the three groups, assuming all expect b.

A.3) Compute the actual patronage benefit, using equation 37.

A.4) If the actual benefit is smaller (larger) than the initial guess by more than an iteration threshold, choose a smaller (larger) new guess and repeat steps (A.1) to (A.4); otherwise stop.

B) Computing the transition.

B.1) Make an initial guess for patronage benefits to be granted in period t.

B.2) Compute the life time (economic) utilities of all young citizens in period t, and determine which citizens will belong to each of the three groups, assuming all expect b_t^e and using that all have already computed b_{t+1}.

B.3) Compute the actual patronage benefit for period t, using equation 36 and b_{t+1} from the previous iteration.

B.4) If the actual benefit is smaller (larger) than the initial guess by more than an iteration threshold, choose a smaller (larger) new guess and repeat steps (B.1) to (B.4); otherwise start step B1 for the previous period.

3   The Computable General Equilibrium Model

3.1   The setting

a) Utilities

Citizens are assumed to have a CRRA (consumption) utility:

$$u\left(c\right) = \frac{c^{1-\gamma} - 1}{1 - \gamma} \tag{38}$$

Utility of clients can be computed from equations 32 and 38:

$$U_t^{Client}\left(w\right) = \frac{\left(w\left(1 - \varepsilon\right)\right)^{1-\gamma} - 1}{1 - \gamma} + \beta \frac{\left(b_{t+1}\right)^{1-\gamma} - 1}{1 - \gamma} \tag{39}$$

A citizen who decides to contribute to social security chooses consumption and savings to solve the following program:

$$\begin{aligned}
\underset{c_{y,t},\, c_{o,t+1}}{Maximize} \quad & \frac{c_{y,t}^{1-\gamma} - 1}{1 - \gamma} + \beta \frac{c_{o,t+1}^{1-\gamma} - 1}{1 - \gamma} \\
s.t.: \quad & c_{y,t} + s_{y,t} \leq \left(1 - \tau\right) w \\
& c_{o,t+1} \leq R s_{y,t} + p \\
& 0 \leq s_{y,t}
\end{aligned} \tag{40}$$

Consumption of credit rationed contributors is:

$$c_{y,t}^R = \left(1 - \tau\right) w \tag{41}$$

$$c_{o,t+1}^R = p \tag{42}$$

Consumption of non-rationed contributors is:

$$c_{y,t}^N = \frac{\left(1 - \tau\right) w + \frac{p}{R}}{1 + \beta^{\frac{1}{\gamma}} R^{\frac{1-\gamma}{\gamma}}} \tag{43}$$

$$c_{o,t+1}^N = \frac{\left(\beta R\right)^{\frac{1}{\gamma}} \left[\left(1 - \tau\right) w + \frac{p}{R}\right]}{1 + \beta^{\frac{1}{\gamma}} R^{\frac{1-\gamma}{\gamma}}} \tag{44}$$

The credit constraint is binding if the unconstrained optimal young-age consumption is larger than the young-age disposable income:

$$\left(1 - \tau\right) w < \frac{\left(1 - \tau\right) w + \frac{p}{R}}{1 + \beta^{\frac{1}{\gamma}} R^{\frac{1-\gamma}{\gamma}}} \tag{45}$$

Therefore, utility of contributors in an optimum is:

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$$U_t^{Cont}(w) = \begin{cases} \dfrac{\left(c_{y,t}^R\right)^{1-\gamma}-1}{1-\gamma} + \beta\dfrac{\left(c_{o,t+1}^R\right)^{1-\gamma}-1}{1-\gamma} & , \;\; if \;\; w < \dfrac{pR^{\frac{1-\gamma}{\gamma}}}{R(1-\tau)\beta^{\frac{1}{\gamma}}} \\[4mm] \dfrac{\left(c_{y,t}^N\right)^{1-\gamma}-1}{1-\gamma} + \beta\dfrac{\left(c_{o,t+1}^N\right)^{1-\gamma}-1}{1-\gamma} & , \;\; otherwise \end{cases} \tag{46}$$

A non-client evader solves:

$$\begin{aligned} \underset{c_{y,t},\,c_{o,t+1}}{Maximize} \quad & \frac{c_{y,t}^{1-\gamma}-1}{1-\gamma} + \beta\frac{c_{o,t+1}^{1-\gamma}-1}{1-\gamma} \\ s.t.: \quad & c_{y,t} + s_{y,t} \le w\,(1-\varepsilon) \\ & c_{o,t+1} \le R s_{y,t} \\ & 0 \le s_{y,t} \end{aligned} \tag{47}$$

and the utility of a non-client evader evaluated at the optimal consumption is:

$$\begin{aligned} U_t^{NCE}(w) \;=\; & \left(\frac{1}{1-\gamma}\right)\left[\left(\frac{(1-\varepsilon)\,w}{1+\beta^{\frac{1}{\gamma}}R^{\frac{1-\gamma}{\gamma}}}\right)^{1-\gamma} - 1\right] + \\ & + \left(\frac{\beta}{1-\gamma}\right)\left[\left(\frac{(\beta R)^{\frac{1}{\gamma}}(1-\varepsilon)\,w}{1+\beta^{\frac{1}{\gamma}}R^{\frac{1-\gamma}{\gamma}}}\right)^{1-\gamma} - 1\right] \end{aligned} \tag{48}$$

b) Parameter values

The coefficient of relative risk aversion (γ) was set equal to 5, based on Reinhart and Végh (1994) estimations of the coefficient of intertemporal substitution ($1/\gamma$) around 0.2.

The simulations include one hundred classes of workers with different wages. The frequencies of the population in the wage classes were estimated fitting a Weibull distribution on a recent survey of households of Uruguay (INE 1999).

The contribution rate τ was set equal to 0.3, which is close to actual figures in several countries. The pension level was chosen to get a replacement ratio (pension/wage of contributors) close to actual figures in several less developed countries (World Bank 1994, Mesa-Lago and Bertranou 1998).

Lacking direct evidence on the value of the "informality cost" parameter (ε), it was set equal to 0.18 to get interesting frequencies of clients, contributors and non-client evaders in equilibrium.

The world interest rate, the subjective discount rate and the rate of growth of the population are the three exogenous rates of growth in this model, and have dimension $1/t$. Citizens live two periods and hence each period is half of a citizen life time, which was assumed to last 70 years. The model gross interest rate, for instance, is equal to the annual gross interest rate raised to 35 years.

These exogenous rates of growth must satisfy several constraints to get results in line with actual data. First, the interest rate and the subjective discount rate should not be too different for agents to smooth consumption along their life span. The simulations were made under the assumption of complete smoothing, i.e. the interest rate and the subjective discount rate were assumed equal.

Second, the rate of growth of the population determines the demographic dependency ratio, i.e. the ratio of old to young citizens in the society (N_{t-1}/N_t). The demographic dependency ratio in the model is the ratio of the population above over the population below 35 years old. This dependency ratio is not especially appropriate to simulate real world pension systems, because real world workers, unlike the agents in the model, do not spend so much time retired as they do working. Because of this unrealistic life cycle, the model would yield unduly negative figures for social security accounts if it were simulated using real world rates of growth of the population. To avoid this difficulty without adding complexity, the rate of growth of the population was chosen to get the model demographic dependency ratio close to a real world demographic dependency ratio *relevant for social security*. A demographic dependency ratio commonly used for social security is the population above 60 years old over the population above 20 and below 60 years old. This ratio was about one third in Uruguay in 1995 (DGEC 1989). The model was simulated with the rate of growth of the population that produces a demographic dependency ratio of one third.

It should be noticed that this calibration procedure avoids getting too high dependency ratios in a two-periods-OLG model, but at the expense of assuming high rates of growth of the population. The annual rate of growth needed to get a dependency ratio of one third in this model is $3^{1/35} - 1 = 0.0319$, which is indeed too high compared to real world figures. In turn, this high rate of growth of the population biases up the estimation of the implicit rate of return of the PAYG social security system in the model. Real world systems do not get those rates of return based only on population growth. However, real world social security systems may still yield implicit annual

rates of return in the order of three per cent based on labor productivity growth. Productivity growth was assumed away in the model, and hence the rate of return to contributions to social security obtained in the model is not unrealistically high.

Third, there is some empirical evidence showing that modern economies are dynamically efficient, implying that the return of mature PAYG social security systems is smaller than the interest rate (Feldstein 1974). In terms of the model, this constraint means that the interest rate must be larger than the rate of growth of the population. The annual interest rate was set equal to 0.04, implying a gross interest rate for the 35-years period $R = 3.94$.

3.2   Simulation results

In order to highlight the effects of patronage benefits in the pension system, a benchmark case in which professional managers rule the system is presented first (Table 1). These managers stick to the formal rules, paying a flat pension only to old workers who contributed in activity. There may be evaders, but they are not entitled to any kind of transfers from the pension system. The same economy is simulated later with politicians ruling the pension system (Table 2).

The model was simulated along several periods, beginning with a steady state of the economy previous to the introduction of the pension system ("Pre-Social Security" in Tables 1 and 2). During the first period with the pension system ("Early Phase"), young workers pay contributions, but old workers do not receive pensions. Old workers in the early phase have not contributed when they were active and are not entitled to pensions. Accordingly, professional managers build up a pension fund during this period. The benchmark case is thus a defined-benefit-fully-funded pension system. If the system is ruled by politicians, some old workers receive transfers from the pension system even during the early phase, and the system fails to build up a pension fund. The country ends up with a pay-as-you-go pension system.

Citizens learn about the rules of the pension system during the early phase. Hence, the introduction of the pension system is modeled as an unanticipated shock. The simulation ends with a steady state of the economy with a mature pension system ("Final SS" in Tables 1 and 2).

In the benchmark case, both patronage benefits and the frequency of clients in the population are zero by assumption (Table 1, rows 1 and 4.1, respectively). Pensions were chosen to be constant at the precise level needed

to get the per-capita pension fund equal to its steady state value from the beginning (row 8). [4] The ratio of pension over average wage of contributors, the replacement ratio, is 1.18 (row 3). The pension-wage ratio is smaller when it is computed with the average wage of the population (row 2). This is due to the presence of evaders (row 4.3) richer than contributors. Rich workers may have incentives to evade contributions despite of the "informality cost", because of the redistributive effects of a flat pension combined with a constant contribution rate. There are three contributors per pensioneer, from the second period of the pension system onwards (row 5).

Insert Table 1

Total domestic savings are equal to private savings before the introduction of the pension system (Table 1, rows 7.1 and 7.3). Old citizens dissave what they have saved in their youth. Nevertheless, thanks to the population growth, aggregate private savings are positive in the pre-social security era.

Private savings turn into negative in the first period of the pension system. Old workers continue dissaving what they have saved before, but young workers who contribute to the social security system reduce their savings. Contributors save less because both their young-age disposable income decreases and their old-age disposable income increases. Domestic savings rise during the early phase of the pension system, despite of the fall in private savings, due to the accumulation of the pension fund. Provident savings only partially crowd out voluntary savings. Some workers have to pay contributions to social security that are larger than the voluntary savings they made before the introduction of the pension system. Even if they reduce their voluntary savings to zero, which is the minimum given the credit constraint, their contribution to total domestic savings rise.

In the second and following periods of the pension system, domestic savings decrease, compared to the early phase, but are still well above the pre-social-security savings. Private savings rise with respect to the early phase, because old workers in these periods dissave less than old workers in the early phase. This is because they also saved less when they were young.Therefore, private savings rise, compared to the early phase, but still stay below the pre social security level. Savings in the pension system decrease compared to the early phase, but remain positive and high enough to get domestic savings in

---

[4]If the economy is dynamically efficient, pensions and contributions cannot be constant forever, unless these constant parameters are exactly what is needed to have the per-capita pension fund at its steady state value. Otherwise, the per-capita assets accumulated in the pension system would diverge.

Table 1: The pension program ruled by professional managers

Endogenous variables	Pre-Social Security	Early Phase	Mature Social Security
1. Patronage benefit/Average wage	**---**	0,00	0,00
2. Pension/Average wage	0,00	0,00	1,13
3. Pension/Average wage of contributors	---	---	1,18
4. Frequencies (members of generation t)			
4.1. Clients	---	0,00	0,00
4.2. Contributors	---	0,98	0,98
4.3. Non-client evaders	---	0,02	0,02
4.4. Total	1,00	1,00	1,00
5. Contributors/pensioneers	---	---	3,00
6. Contributors/(pensioneers+clients)	---	---	3,00
7. Savings (per capita)			
7.1. Private	3,22	-1,22	0,26
7.1.1. Young citizens	4,84	0,39	0,39
7.1.2. Old citizens	-1,61	-1,61	-0,13
7.2. Social Security System	0,00	26,81	17,88
7.2.1. Primary surplus	0,00	26,81	-8,40
7.2.2. Interest received on pension fund	0,00	0,00	26,28
7.3. Total Domestic Savings	3,22	25,59	18,14
8. Pension Fund (per capita)	0,00	26,81	26,81

Parameters	
Gamma	5,00
Rate of contribution	0,30
Informality cost	0,18
Interest rate (gross)	3,94
Discount factor	0,25
Rate of growth of the population	2,00

this periods above domestic savings in the pre-social-security era. The primary surplus that the pension system exhibited in the early phase turn into a primary deficit when the pensions have to be paid. However, the proceeds from the pension fund outweigh the primary deficit, determining an overall surplus in the pension system.

The outcome is very different when the pension system is ruled by politicians using patronage benefits to increase their probabilities of winning the elections. Politicians do not build a pension fund during the early phase of the system. They rather use the proceeds of workers contributions to give transfers to buy political support. Lacking a pension fund, the system cannot support a pension as large as the one provided in the benchmark case. Workers know it so they expect a lower pension. Citizens observe during the early phase that the pension system pays patronage benefits (Table 2, row 1) and that there is no accumulation of a pension fund. With this data, citizens realize that the system cannot pay pensions as large as 1.13 times the average wage. Suppose that all citizens expect a pension equal to 0.78 average wages. Then, as the example in Table 2 shows, there is a politico-economic equilibrium in which the pension system actually pays this amount, and distributes patronage benefits.

<div align="center">Insert Table 2</div>

During the early phase, politicians distribute patronage benefits among the currently old. There is much to distribute in this period, so the consumption warranted to beneficiaries of transfers is as much as 1.3 average wages, and 84 per cent of the currently old citizens receive transfers. Only the richest 16 per cent of the old citizens in the early phase do not receive any transfer from the pension system. As a consequence of these transfers, the pension system runs no surplus. Therefore, a pension system designed to be fully funded ends up being a pay-as-you-go system.

Only 60 per cent of the working population contributes to social security. The poorest 26 per cent does not contribute to the pension system and does not save, making themselves elegible for receiving patronage benefits in the following period. This figure is much smaller than the 84 per cent of clients in the early phase. The decline in the number of political clients is due to the end of the "easy" phase of the pension system. Young citizens in the early phase know that politicians will not have so much money to distribute among clients in the second period as they had during the early phase, because the system will have to pay pensions. Also, unlike in the early phase, political clients in the second and following periods of the pension

<div align="center">24</div>

Table 2: The pension program ruled by politicians

Endogenous variables	Pre-Social Security	Early Phase	Mature Social Security
1. Patronage benefit/Average wage a/	---	1,30	0,32
2. Pension/Average wage	---	---	0,78
3. Pension/Average wage of contributors	---	---	0,77
4. Frequencies (members of generation t)			
4.1. Clients	0,84	0,26	0,26
4.2. Contributors	---	0,60	0,60
4.3. Non-client evaders	0,16	0,15	0,15
4.4. Total	1,00	1,00	1,00
5. Contributors/pensioneers	---	---	3,00
6. Contributors/(pensioneers+clients)	---	---	2,10
7. Savings (per capita)			
7.1. Private	3,22	-0,23	0,92
7.1.1. Young citizens	4,84	1,38	1,38
7.1.2. Old citizens	-1,61	-1,61	-0,46
7.2. Pension System	0,00	0,00	0,00
7.2.1. Primary surplus	0,00	0,00	0,00
7.2.1.1. Pre-patronage surplus	0,00	17,53	2,61
7.2.1.2. Patronage benefits	0,00	-17,53	-2,61
7.2.2. Interest received on pension fund	0,00	0,00	0,00
7.3. Total Domestic Savings	3,22	-0,23	0,92
8. Pension Fund (per capita)	0,00	0,00	0,00

Parameters	
Gamma	5,00
Rate of contribution	0,30
Informality cost	0,18
Interest rate (gross)	3,94
Discount factor	0,25
Rate of growth of the population	2,00

a/ Actual consumption of clients in the early phase. In the following periods, consumption of clients coincide with patronage benefits.

system play strategically choosing zero young-age savings, raising the cost of buying political support. This decision is individually rational because citizens know that politicians target a uniform consumption level among clients. Saving more would simply mean reducing young-age consumption without increasing old-age consumption.

The richest 15 per cent of the working population during the early phase evades contributions, without becoming political clients. The number of non-client evaders is larger when the system is ruled by politicians than by professional managers, because of the lower pension. Patronage benefits raise the cost of the system, increasing the incentives for rich workers to evade.

The loss of the two tails of the distribution leaves the pension system with only middle class contributors, and a low coverage among the working population.

Domestic savings become negative during the early phase, due to negative private savings and zero pension savings. Comparing to the benchmark case, the most striking change is the reduction of the pension savings to zero. Private savings are of a much smaller amount. Furthermore, private savings are less negative in the system ruled by politicians than by professional managers, because workers who contribute anticipate that the pension will be smaller because of patronage benefits.

In its second period, the system starts paying the pension anticipated during the early phase to all those who contributed. It also pays the expected patronage benefits to all those who did not contribute and did not save. Contributions received from active workers balance the pension accounts. Hence, individual expectations and decisions are consistent in the aggregate, and there are no surprises.

The frequencies of clients, contributors and non-client evaders among the working population in the second period of the pension system remain the same as in the early phase.There are three contributors per pensioneer, but only 2.1 per beneficiary, because of clients. Therefore, clientelism raises the social security dependency ratio.

Domestic savings are larger in the second than in the first period of the pension system, because of the reduction in old citizens dissavings. Comparing with the benchmark case, the domestic savings in the second period of the pension system are smaller, due to the significantly smaller savings in the pension system, and despite of moderately larger private savings.

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4 Concluding remarks

The model in this paper shows how political parties that exchange benefits for votes may exhaust the pension fund. A pension system that is initially designed to be funded ends up being PAYG. Moreover, the short run logic of this electoral competition does not warrant that the resulting PAYG system continues being sustainable with the initial parameters (replacement ratios, contribution rates, etc.).

The first generations, those who are old during the early phase of the pension system, are the main beneficiaries of the discretionary transfers. Among them, redistribution tends to favor the poorest segments of the population. Following generations are mostly damaged by these transfers, with the exception of their poorest members.

The intergenerational redistribution in this paper is driven by the asymmetric ability of politicians to commit patronage benefits to different generations through the pension system. Politicians can commit -and therefore include in their electoral platforms- pensionary benefits to be granted to old citizens after the elections. But they do not have the same ability to commit benefits to be distributed to the currently young citizens many years ahead, even if they win current elections, because they may not be in office for so long. Moreover, politicians cannot please young voters offering not to distribute benefits among the currently old, for citizens cannot verify such promises. Hence, young voters are not able to discipline politicians with their vote. Because of these asymmetries, old voters are more responsive than young voters to promises of pensionary benefits offered during the electoral campaigns. Accordingly, old voters receive better offers.

On the normative side, the results in this paper suggest that the pension systems should be kept as far as possible from electoral competition. Of course, this is not simple. Privatization is one possible answer, but it is not free from problems. First, citizens may want to have some degree of redistribution to alleviate poverty, and this is something that the private sector cannot do. The public social security system is the main institution to perform programmatic redistribution in modern economies.

Second, it is costly to substitute PAYG for fully funded pension systems. Substituting the PAYG system involves, one way or another, a transfer from the living generations, while the main beneficiaries of the PAYG systems are not alive any longer. In most countries, these transfers would be very large. They would be less so, however, in countries in which the pension

programs cover small segments of the population, like in many developing countries. Also, partial privatization may be a solution. It is less costly than full privatization, and it reduces the ability of politicians to use the pension system for electoral competition, while keeping some room for programmatic redistribution.

Three, the privatized system requires regulation and, as Orszag and Stiglitz (1999) have emphasized, a government that is inefficient in managing a public pension system may also be inefficient in regulating a private one. Nevertheless, if the political inefficiency is of the type analyzed in this paper, i.e. the use of the pension fund to "buy" votes, the government could be unable to manage the trust fund properly, while being capable of regulating a private system.

In any case, the model in this paper does not imply that privatization or individual accounts are the unique or even the best available solutions. The benchmark simulation presented in this paper is a public defined benefit system that succeeds in building a trust fund, and faces no financial hardship associated with the maturing of the pension system. The key for this result is that the system is assumed to be administered by professional managers that simply stick to the social security law. Recent proposals to give the social security administration more independence and a complete separation from the government budget basically aim at producing this outcome. Canada is currently experiencing this approach.

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