ELSEVIER

Journal of Public Economics 91 (2007) 2041 – 2061

JOURNAL OF PUBLIC ECONOMICS

www.elsevier.com/locate/econbase

Voting over type and generosity of a pension system when some individuals are myopic ☆

Helmuth Cremer [a], Philippe De Donder [b,*], Dario Maldonado [c], Pierre Pestieau [d]

[a] *University of Toulouse, GREMAQ and IDEI, France*
[b] *Toulouse School of Economics (GREMAQ-CNRS and IDEI), France*
[c] *Universidad del Rosario, Bogota, Colombia*
[d] *University of Liège, CORE, PSE and CEPR, Belgium*

Received 17 September 2006; received in revised form 16 March 2007; accepted 18 June 2007
Available online 26 June 2007

Abstract

This paper studies the determination through majority voting of a pension scheme when society consists of far-sighted and myopic individuals. All individuals have the same basic preferences but myopics tend to adopt a short-term view (instant gratification) when dealing with retirement saving and labor supply. Consequently, they will find themselves with low consumption after retirement and regret their insufficient savings decisions. Henceforth, when voting they tend to commit themselves into forced saving. We consider a pension scheme that is characterized by two parameters: the payroll tax rate (that determines the size or generosity of the system) and the "Bismarckian factor" that determines its redistributiveness. Individuals vote sequentially. We examine how the introduction of myopic agents affects the generosity and the redistributiveness of the pension system. Our main result is that a flat pension system is always chosen when all individuals are of one kind (all far-sighted or all myopic), while a less redistributive system may be chosen if society is composed of both myopic and far-sighted agents. Furthermore, while myopic individuals tend to prefer larger payroll taxes

☆ This paper has been presented at the "8th Conference of the RTN on the Economics of Aging" (Paris, May 2006), the "Trans Atlantic Public Economics Seminar on Public Policy and Retirement", (Uppsala, June 2006), the "Eight International Meeting of the Society for Social Choice and Welfare" (Istanbul, July 2006) and in a seminar at the University of Aix-Marseille. We thank all the participants for their remarks. We are particularly grateful to Sören Blomquist, Richard Disney, Amy Finkelstein, Dirk Krueger, Jim Poterba and Alain Trannoy for their insightful comments. Last but not least, we thank the referees for their helpful comments and suggestions.

* Corresponding author.
E-mail address: dedonder@cict.fr (P. De Donder).

doi:10.1016/j.jpubeco.2007.06.001

than their far-sighted counterparts, the generosity of the system does not always increase with the proportion of myopics.

JEL classification: H55; D91
Keywords: Social security; Myopia; Dual-self model

1. Introduction

It has long been suspected and recent work has investigated the possibility that individuals may be "myopic" and not adequately save for their retirement unless a mandatory pension system forces them to do so. In his AEA Presidential address Peter Diamond brings out this point in a forceful way by saying: "To my mind, the heart of the context for thinking about Social Security is that it substitutes for poor decision making and for missing insurance opportunities (missing perhaps because poor decision making implies low demand). The various shortcomings in preparation for retirement relate to different issues — inadequate overall provision for retirement relates to having a mandatory program […]".[1] Similarly, Assar Lindbeck and Mats Persson (2003) argue: "A justification (for having a mandatory pension system) is based on paternalism: a mandatory system prevents myopic individuals from ending up in poverty in old age.[…] A person of this type is well served by some kind of commitment device, which could consist of a mandatory pension system, that prevents him from procrastinating. So far, however, there does not seem to be any formal political-economy model that explains how such a disciplinary device could be introduced and maintained by collective decision-making."

The notion of myopia we have in mind refers to the idea that people behave differently when they make short-run decisions and when they consider long-run trade-offs. To put it differently they acknowledge in surveys not to save enough for retirement and *ex post*, when it is too late they regret not to have saved more.[2] Undersaving can also result from the complexity of the retirement problem. Because this problem is beyond the reach of ordinary workers, a significant number may err by saving too little. Whatever the explanation for undersaving might be, it clearly leads to what has been called "new paternalism".[3] The idea is that the government has to intervene in retirement savings and that its objective should depend on something other than the objectives that govern individuals' short-run decisions. The government ought to consider the long-term impact of decisions that individuals fail to consider because of problems of self-control or of complexity. The new paternalism is associated with the burgeoning field of behavioral economics and goes beyond the issue of forced saving; it has been applied to a set of activities such as smoking, drinking, overeating and gambling.

In most of these papers, the approach is normative: a benevolent government uses a second-best policy that induces individuals to make decisions that coincide as much as possible with their long-run welfare. This is the approach we use in a companion paper (Cremer et al., in press) to study the optimal design of a linear pension scheme when myopic and far-sighted individuals coexist.

In this paper we adopt a positive approach and present a simple political economy model in order to fill (at least in part) the gap mentioned by Lindbeck and Persson. We consider a society in which coexist two types of individuals: far-sighted ones who do not have to be forced to save and myopic ones. Individuals are also distinguished by their productivity. We assume that behind a kind of veil of ignorance myopic individuals are in a state of grace: they vote for the policy

[1] Diamond (2004).
[2] This idea goes back to Strotz (1956). See also Angeletos et al. (2001).
[3] See Benabou and Tirole (2004).

parameters by using their "true", long run, preferences while anticipating that they will make some decisions in a myopic way. In other words, at the moment they vote, they try to determine the social security system that will act as a commitment device. Observe that we use the term "myopic" for simplicity even though it is admittedly somewhat misleading. The problem with these individuals is not so much their short-sightedness, but their lack of self-control when savings and consumption decisions are made. At the voting stage these individuals effectively have a rather sophisticated behavior in that they anticipate their future (mis)behavior.[4] A possible justification for this combination of sophisticated and myopic behavior is the fact that voting is a low frequency event which can serve as a commitment mechanism while savings decisions are made in a continuous (and often reversible way) which creates more opportunities to breach one's original plans.[5]

We adopt a rather simple framework, namely a linear scheme with a uniform payroll tax rate and pension benefits that have a contributory (Bismarckian) part and a flat rate (Beveridgean) part. To keep the model simple, we assume that the same distribution of productivity prevails in the two groups.

Individuals vote for two parameters: the tax rate that measures the size of the system and the relative importance of flat rate pension that measures the redistributiveness of the system. On the basis of these parameters, they then choose both their labor supply and their saving, if any. Myopic individuals do not save; yet when they vote they use the preferences of their rational "self". In other words, they seize the opportunity of voting to commit themselves to some forced saving knowing that as soon as out of the voting booth their myopic self will prevail.[6]

People vote sequentially. They first vote on the *type* of pension system, Bismarckian or Beveridgean. Intermediate solutions are not considered in the main part of the paper for reasons of simplicity. They then vote on the tax rate which determines the size or *generosity* of the system. We show that whereas with homogeneous societies (only myopic or only far-sighted) the majority always votes for a Beveridgean pension system, with mixed societies, a Bismarckian system can emerge. Second, the relationship between tax rate (generosity) and the proportion of myopic individuals is more complicated than one would have conjectured. Intuitively one would predict a positive relationship because myopic individuals tend to prefer larger payroll taxes than their far-sighted counterparts. We show that this is indeed true for logarithmic utility functions with a specific distribution of productivities. However, more sophisticated patterns can emerge with alternative preferences. In particular we provide an example where the generosity is not a monotonic function of the proportion of myopics. Third, we find cases in which both stages of the vote yields an "ends against the middle" solution, where low and high ability voters oppose the ones with intermediate ability.

The remainder of this paper is organized as follows. The model is presented in Section 2. Section 3 analyzes voters' preferences in the second stage of the voting game *i.e.*, the vote on the *size* of the system given its *type* (Bismarckian or Beveridgean). Section 4 studies the equilibrium of the voting game in "homogenous" societies (all far-sighted or all myopic). Section 5 deals with heterogenous societies. We first provide an in-depth study of the logarithmic utility case (Subsection 5.1) and then show (Subsection 5.2) how the results are amended under alternative

[4] Our analysis could easily be adapted to accommodate for the existence of "full myopics", namely individuals who both save and vote myopically. This would simply add a mass of individuals who want a zero payroll tax and who do not care for the type of system.

[5] We thank Amy Finkelstein for suggesting this interpretation.

[6] This type of behavior is consistent with the evidence presented by Laibson et al. (1998). These authors argue that "Their use of such commitment devices implies that consumers have, and are aware of, problems of self-control". See, however, Mc Laffery (2006) who takes exception to the view that myopic individuals might be led to save by public policy devices.

CES preferences (with more or less intertemporal substitution than the logarithmic case). Finally, in Section 6, we introduce the possibility that an intermediate type of system is available.

2. The model

2.1. Types of individuals, preferences and pension systems

There are two types of individuals, the far-sighted and the myopic. Utility of far-sighted individuals is given by

$$U = u(x) + u(d) = u(c - \ell^2/2) + u(d), \tag{1}$$

where c and d are first- and second-period consumption, ℓ is first-period labor supply and $x=c-\ell^2/2$ is consumption net of the (monetary) disutility of labor. In the second period individuals are retired. The interest rate and the rate of population growth are both equal to zero. Utility function (1) is also that of myopics *ex post*. It corresponds to their rational self. *Ex ante*, the myopics totally forgo the second period; accordingly, they do not save and choose labor supply to maximize

$$U_{\mathrm{M}} = u(x) = u(c - \ell^2/2). \tag{2}$$

In addition to this distinction, individuals differ also in productivity $w \in [w_-, w_+]$. The distribution of w is independent of the proportion λ of myopics in the population.[7] It satisfies the standard property that the median wage, w^{med}, is smaller than the mean wage $\bar{w}$. Define

$$\theta_i = \frac{w_i^2}{Ew^2},$$

where E is the expectation operator. In the remainder of the paper we often find it convenient to index individuals by their level of θ rather than by w. The distribution of abilities w generates a distribution of θ that is denoted by $F(\theta)$. By definition, the average value of θ, denoted $\bar{\theta}$, equals 1 and one readily verifies that $\theta^{\mathrm{med}} < \bar{\theta} = 1$ (where θ^{med} is the median).[8]

Throughout the paper, we will restrict ourselves to the family of constant elasticity of substitution utility functions:

$$u(x) = \frac{x^{\varepsilon}}{\varepsilon}. \tag{3}$$

With this specification, the elasticity of substitution is given by $\rho = 1/(1-\varepsilon)$. Note that $\varepsilon=0$ yields a logarithmic utility (with $\rho=1$); $\varepsilon<0$ yields $\rho<1$ (complements) while $0<\varepsilon<1$ yields $\rho>1$ (substitutes).

The pension system consists of a payroll tax τ and pension benefits p_i that are equal to

$$p_i = \tau(\alpha w_i \ell_i + (1-\alpha) Ew\ell) \tag{4}$$

where $Ew\ell$ is the average before-tax income. The parameter α is often called the Bismarckian or the contributory parameter. When $\alpha=0$, we have a flat-rate benefit (Beveridgean) pension system with $p_i=p=\tau Ew\ell$. When $\alpha=1$, we have $p_i=\tau w_i \ell_i$ so that an individual's pension is proportional

[7] In one of the few papers yielding evidence on what we call myopia or shortsightedness, Arrondel et al. (2005) find that there is no correlation between this characteristic and either income or wealth.

[8] To show this, use $w^{\mathrm{med}} < \bar{w}$ along with the definition of θ_i and Jensen's inequality.

to his contributions (*i.e.*, the system is purely contributive). Note that with zero interest and population growth rates it does not matter whether pensions are fully funded or based on the pay-as-you-go principle.

The parameters α and τ are chosen by majority voting. The choice is restricted to "pure" Beveridgean or Bismarckian systems by imposing $\alpha \in \{0,1\}$. A sequential procedure is considered where the type of system (represented by α) is determined first, while the payroll tax rate τ (which in turn determines the generosity of the system) is set in a second stage. The sequence appears rather natural, the type of social security, contributive or not, being a more fundamental feature than its generosity. The problem is solved by backward induction. We assume that *all* individuals vote according to their "true" (*ex post*) preferences. However, the myopics will make their savings (and labor) supply decisions according to their *ex ante* preferences represented by Eq. (2) and they do anticipate this at the voting stage.[9]

Before turning to the study of the voting procedure, we have to examine the individuals' labor supply and savings decision in the presence of a Beveridgean or a Bismarckian pension system.

2.2. Labor supply and savings under a pension system

An individual now solves

$$\max_{l_i, s_i} u(w_i(1-\tau)\,\ell_i - s_i - \ell_i^2/2) + \beta_i u(s_i + p_i), \quad \text{s.t. } s_i \geq 0, \tag{5}$$

where $\beta_i = 0$ if he is myopic and $\beta_i = 1$ if he is far-sighted.

The solution (at least for the far-sighted) depends on the link between second period consumption and labor supply decisions which in turn depends on the pension system. We solve the problem separately for a Beveridgean and a Bismarckian system.

2.2.1. Beveridgean system: $\alpha = 0$

In that case, there is no link between pension and individual contributions so that the optimal labor supply is

$$\ell_i^* = w_i(1-\tau), \tag{6}$$

both for the far-sighted and for the myopics.[10] The savings pattern is characterized in the following Lemma that is established in Appendix A1.

Lemma 1. *Under a Beveridgean pension system, the savings pattern is as follows:*

(i) $s_i = 0$ *for all the myopics and for the far-sighted with* $\theta \leq 2\tau/(1-\tau)$*;*
(ii) $s_i > 0$ *for the far-sighted with* $\theta > 2\tau/(1-\tau)$*.*

[9] Throughout the paper we consider only a single generation and effectively assume that the voting game is only played once. In an intergenerational setting (and with our assumption on population growth and interest rate) this would correspond to a steady state of a sequence of votes where at each period only the young vote and make the (*ad hoc*) conjecture that the system they adopt will also be adopted by the next generation. This is clearly restrictive but at this point necessary for tractability. It would have been more consistent to provide on explicit modelling of the intergenerational game (following for instance Boldrin and Rustichini, 2000).

[10] The property that labor supply is independent of β is of course due to the specification of preferences (there is no income effect).

To sum up, with a flat pension myopics, as well as the low ability far-sighted, do not save; high ability far-sighted save and equalize consumption and marginal utility across the two periods.

2.2.2. Bismarckian system: $\alpha=1$

The individual now solves Eq. (5) with $p_i=\tau\, w_i \ell_i$. Labor supply of the myopics does not depend on the pension system and thus continues to be given by Eq. (6). For the far-sighted labor supply does depend on the pension system and we have

$$\ell_i^* = \begin{cases} w_i & \text{when } s_i > 0 \\ w_i\left(1-\tau\left(1-\dfrac{u'(p_i)}{u'(x_i)}\right)\right) & \text{when } s_i = 0, \end{cases} \tag{7}$$

The far-sighted who save see the link between pension and labor income so that their labor supply is not distorted. Far-sighted who do not save put a lower weight on second period consumption (because of lower marginal utility of consumption) and are in between the other two categories in terms of labor supply. This is in sharp contrasts with the Beveridgean case where labor supply was similarly distorted for myopic and far-sighted individuals.

Turning to the saving decision, differentiating the indirect utility function (A2) with respect to s_i, making use of Eq. (7) and solving yields the following lemma:[11]

Lemma 2. *Under a Bismarckian pension system, the saving pattern is as follows*

(i) $s_i=0$ for all myopics and, if $\tau\geq 1/4$, for all the far-sighted,
(ii) $s_i>0$ for all the far-sighted if $\tau<1/4$.

Consequently, there is no minimum productivity required for the far-sighted to save. Public pension and private savings have the same rate of return. In the absence of a pension system the far-sighted save 1/4 of their income. As long as $\tau\leq 1/4$, social security perfectly crowds out private saving which is determined by an interior solution so that consumption is perfectly smoothed across the two periods ($x=d$). For $\tau>1/4$, nobody saves (corner solution).

We are now in a position to study the determination of α and τ through the voting procedure. We start with the second stage and determine the voters' preferences over payroll tax rates in both Bismarckian and Beveridgean systems.

3. Most-preferred payroll tax rates for a given level of α

Let $\tau^*(\theta, \alpha)$ denote the most-preferred tax rate of individual θ given the type of social security system with $\alpha=0$ or $\alpha=1$. We successively study Beveridge ($\alpha=0$) and then Bismarck ($\alpha=1$) and naturally distinguish between myopic and far-sighted agents (when necessary). Recall that when voting the myopics adopt the same preferences as the far-sighted, anticipating however that they do not save and that their labor supply is chosen with $\beta=0$.

[11] The FOC for the far-sighted is

$$w_i(1-\tau)\,\ell_i^* - s_i - \frac{\ell_i^{*2}}{2} = s_i + \tau w_i\,\ell_i^*.$$

Substituting for ℓ_i^* (which equals w_i when $s_i>0$) yields $s_i=w_i^2(1-4\tau)/4$ which is positive if $\tau<1/4$.

3.1. Beveridgean case

The results for the CES utility function are summarized in the following proposition, which is established in Appendix A2.

Proposition 1. *When the pension system is Beveridgean ($\alpha = 0$), the pattern of most-preferred tax rates (represented in Fig. 1) depends on the elasticity of substitution between first- and second period consumption; it satisfies the following properties:*

(i) For the myopics, τ^* is constant (at 1/4) when $\varepsilon = 0$. It is increasing with θ when $\varepsilon < 0$ and decreasing when $0 < \varepsilon < 1$.
(ii) The far-sighted with $\theta \leq 2/3$ do not save when τ is at their most-preferred level and have the same level of τ^* as their myopic counterpart.

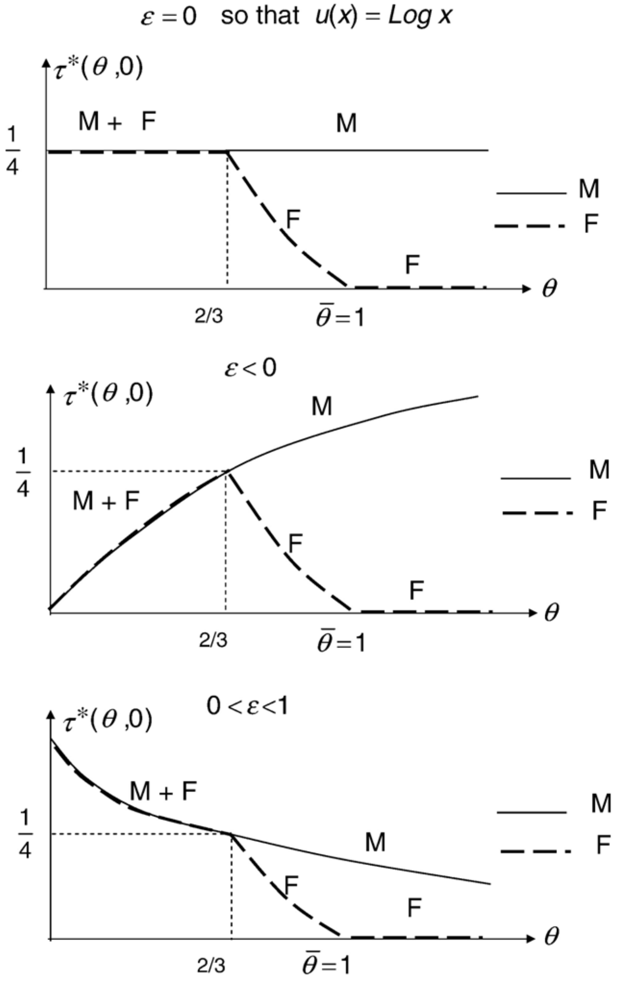

Fig. 1. The pattern of most preferred payroll tax rates under a Beveridgean system depending on the level of the elasticity of substitution.

(iii) *The far-sighted with $\theta > 2/3$ save when τ is at their most-preferred level. For $\theta \in]2/3, \overline{\theta}]$, τ^* is decreasing while $\tau^* = 0$ for $\theta > \overline{\theta} = 1$. All these individuals, have a smaller level of τ^* than their myopic counterparts.*

Intuitively these results can be understood as follows. Part (i) arises because increasing θ has two conflicting effects on the $\tau^*(\theta, 0)$ of a myopic. First, there is a negative income effect because a richer individual benefits less from the redistribution embedded in the Beveridgean program. Second there is a positive substitution effect. As an individual grows richer, his marginal utility of second period consumption increases relative to his first period one, which tends to increase his most-preferred contribution rate. The net impact depends on the elasticity of substitution. When ε is positive, substitution between periods is easy and the income effect dominates. When ε is negative, substitution across periods is difficult, and the substitution effect dominates. For $\varepsilon = 0$, both effects perfectly cancel out. Part (ii) obtains because the "poor" far-sighted who do not save and their myopic counterparts have the same labor supply under Beveridge. Consequently, both groups have the same preferences over τ. Turning to (iii), individuals with $\theta < 1$ benefit from redistribution and want a positive tax. Their preferred contribution rate trades off gains from redistribution and distortions from taxation, so that τ^* decreases with productivity. When $\theta > \overline{\theta} = 1$, private saving is a better instrument than social security to transfer resources across periods. These individuals favor zero pensions and taxes. Finally, at the voting stage, the myopics anticipate their insufficient saving and compensate by increasing forced saving. Consequently, the myopic tends to favor higher taxes than their non liquidity-constrained far-sighted counterparts.

3.2. Bismarckian system

For the far-sighted, there is perfect crowding out between pensions and private saving as long as $\tau < 1/4$. They are indifferent between any $\tau \in [0, 1/4]$. Above 1/4 utility decreases with τ. Individuals are then forced to save more than they want.

As for the myopic, the desired tax rate is characterized by

$$\tau^* = \frac{u'(d_i) - u'(x_i)}{2u'(d_i) - u'(x_i)}. \tag{8}$$

With the CES, specified by Eq. (3), $\tau^*(\theta,1)$ is independent of θ for the myopics. Table 1 gives the most-preferred tax rate for different values of ε.

Table 1
Most-preferred tax rate of the myopics under a Bismarckian system

ε	$\tau^*(\theta, 1)$
−10	0.320
−2	0.294
−1	0.280
−1/2	0.269
−1/4	0.260
0	0.25
1/4	0.234
1/2	0.211
3/4	0.168
9/10	0.113
99/100	0.027

To interpret these results, recall that the elasticity of substitution is given by $\rho=1/(1-\varepsilon)$. When ε tends towards minus infinity, the agent tries to equalize utility levels across periods and favors a tax rate close to 1/3. As ε tends towards 1, the agent only cares about the sum of his two consumption levels. Forced saving then has no benefits and is inefficient because of tax distortions. His most-preferred tax rate tends towards zero. Summing up, we have

Proposition 2. *When the pension system is Bismarckian ($\alpha=1$), the pattern of most-preferred tax rates satisfies the following properties:*

(i) For the far-sighted the most-preferred tax rate is not uniquely defined; we have $\tau^*(\theta, 1)\in[0, 1/4]$.
(ii) For the myopics, the most-preferred tax rate is independent of θ; its level is a decreasing function of ε.

We are now in a position to study the voting equilibrium. We start with the case of "homogenous" societies and then consider societies where myopic and far-sighted individuals coexist.

4. Choice of α in homogeneous societies

In this section, we show that (with CES preferences) *Beveridge is always preferred by a majority to Bismarck in homogenous societies.* We start with a society composed of myopics only and then move to a far-sighted only society.

Let $\tau^{V}(\lambda, \alpha)$ denote the voting equilibrium payroll tax rate (for a given level of α). Recall that $\lambda\in[0, 1]$ denotes the fraction of myopic individuals. It can be shown that preferences over τ for given $\alpha=\{0, 1\}$ are single-peaked for both M and F. Consequently, we can use the median voter theorem to determine τ^{V}. Accordingly, the majority chosen value of τ is the median among the voters' most-preferred values. It should be pointed out that this is not always the most-preferred value of the median θ individual because the most preferred level of τ is not necessarily a monotonic function of θ; see Fig. 1, panel 2.

4.1. Myopics only ($\lambda=1$)

When voting on α individuals evaluate their welfare by considering the induced voting equilibrium: $\tau^{V}(1, 1)$ for Bismarck and $\tau^{V}(1, 0)$ under Beveridge. Our argument makes use of Fig. 1, and we successively consider the three cases depicted there. To determine $\tau^{V}(1, 1)$, we also use Table 1. It provides the most-preferred tax rate of all the myopics under a Bismarckian system which is of course the voting equilibrium in a myopic society.

The case of logarithmic preferences is particularly simple. We have $\tau^{V}(1, 0)=\tau^{V}(1, 1)=1/4$ so that the equilibrium payroll tax is the same under Beveridge and under Bismarck. Consequently, all individuals with $\theta<\overline{\theta}$ prefer Beveridge to Bismarck, and since $\theta^{\mathrm{med}}<\overline{\theta}$ they form a majority. To sum up the voting procedure yields a Beveridgean system (along with $\tau=1/4$).

The other two cases ($\varepsilon<0$ and $0<\varepsilon<1$) are slightly more intricate and relegated to Appendix A3. The equilibrium tax rate is then no longer the same under the two regimes. Nevertheless, the poorest half of the population prefers Beveridge for two reasons. First, it benefits from redistribution (like in the logarithmic case) and, second, the Beveridgean equilibrium tax rate is closer to their most preferred tax rate than the Bismarckian equilibrium one.

4.2. Far-sighted only ($\lambda = 0$)

When deciding upon α, voters now compare their levels of welfare achieved with $\tau^{V}(0, 1)$ and $\tau^{V}(0, 0)$. It follows from Proposition 2, (ii) that $\tau^{V}(0, 1) \in [0, 1/4]$: any $\tau \leq 1/4$ is a voting equilibrium under Bismarck. Moreover all these tax rates yield an allocation that is equivalent to the laissez-faire (no pension) solution. Any "forced" saving through the pension system simply crowds out private savings. This is interesting because it implies that the (second stage) equilibrium for $\alpha = 1$ can also be achieved for $\alpha = 0$, namely by setting $\tau = 0$. The exact determination of $\tau^{V}(0, 0)$ is more complicated, but it follows directly from Fig. 1 (along with the property that preferences are single-peaked) that $\tau^{V}(0, 0) > 0$: with far-sighted individuals only, voting under Beveridge always yields a positive tax rate. This, in turn, implies that a majority of individuals is better off with $\tau^{V}(0, 0)$ than with $\tau^{V}(0, 1)$. In other words, we have established that a Beveridgean system ($\alpha = 0$) will be chosen in the first stage of the voting game.

Unlike in myopic societies, the majority that prefers Beveridge over Bismarck is not always composed of the lowest productivity agents. This can be seen from Fig. 1, panel 2. When $\varepsilon < 0$, we have an "ends-against-the-middle" equilibrium where low and high income people would prefer a lower Beveridgean tax rate, while the middle class would prefer a higher value. The same ends-against-the-middle situation prevails when people have to choose between $\tau = 0$ and $\tau^{V}(0, 0)$. Observe that this is the only case where Beveridge is not supported by the low productivity individuals.

The results of this section are summarized in the following proposition.

Proposition 3. *When all individuals are myopic ($\lambda = 1$) or far-sighted ($\lambda = 0$) a Beveridgean pension system ($\alpha = 0$) is chosen through majority voting. When $\lambda = 1$ or when $\lambda = 0$ and $\varepsilon \geq 0$ the majority that supports Beveridge always includes the poorest half of the population. When $\lambda = 0$ and $\varepsilon < 0$, an "ends-against-the-middle" equilibrium prevails, with the middle class supporting Beveridge while the rich and the poor favor Bismarck.*

5. Choice of α in mixed societies

5.1. The logarithmic utility case

Assume for the time being that $u(x) = \ln(x)$. We shall first state the majority voting equilibrium tax rate in a Beveridgean and in a Bismarckian system. These results will put us in a position to return to the first stage of the voting procedure and study the vote between Beveridge and Bismarck as a function of the proportion of myopics in society.

Simple inspection of Fig. 1 and of Table 1 yields the following results, which are formally proved in Appendix A4.

Proposition 4. *Assume $u(x) = \ln(x)$. The majority voting equilibrium tax rate under a Beveridgean system is given by*

$$\tau^{V}(\lambda, 0) = \begin{cases} 1/4 & \text{if} \quad \lambda + (1-\lambda)F(2/3) \geq 1/2 \\ (1-\hat{\theta})/(2-\hat{\theta}) < 1/4 & \text{otherwise,} \end{cases}$$

where $\hat{\theta} \in]2/3, 1[$ is defined by $\lambda + (1-\lambda)F(\hat{\theta}) = 1/2$. Furthermore, $\hat{\theta}$ is non decreasing in λ and $\hat{\theta} < \theta^{med}$ whenever $\lambda > 0$.

Table 2
Voting equilibrium as a function of the proportion of myopics, when θ is distributed over [0, 16/3] according to a Beta (2,4) and when $u(x)=\ln(x)$

λ	$\hat{\theta}$	$\tau^{V}(\lambda, 0)$	$F(\tilde{\theta}_M)$	$F(\tilde{\theta}_F)$	Support for Beveridge	α^{V}	$\tau^{V}(\lambda, \alpha^{V})$
0	0.941	0.055	–	0.520	0.520	0	0.055
0.02	0.926	0.069	0.213	0.516	0.509	0	0.069
0.05	0.903	0.089	0.287	0.508	0.497	1	0.250
0.10	0.860	0.123	0.392	0.495	0.485	1	0.250
0.125	0.838	0.140	0.433	0.489	0.482	1	0.250
0.250	0.702	0.230	0.536	0.451	0.472	1	0.250
0.275	0.669	0.249	0.539	0.443	0.469	1	0.250
0.277	[0,2/3]	0.250	0.539	0.442	0.469	1	0.250
0.5	–	0.250	0.539	0.442	0.491	1	0.250
0.597	–	0.250	0.539	0.442	0.500	0/1	0.250
0.99	–	0.250	0.539	0.442	0.538	0	0.250
1	–	0.250	0.539	–	0.539	0	0.250

Recall that from the definition of $\tilde{\theta}_M$ and $\tilde{\theta}_F$, $F(\tilde{\theta}_M)$ and $F(\tilde{\theta}_F)$ indicate the proportion of myopics and far-sighted who are in favor of Beveridge. We denote by α^{V} the result of the first-stage vote.

The majority voting equilibrium tax rate under a Bismarckian system is given by

$$\tau^{V}(\lambda, 0) = 1/4, \quad \text{for all } \lambda \geq 0.$$

We then show in Appendix A5 that there exists a threshold myopic individual, $\tilde{\theta}_M$, who is indifferent between Beveridge, $(\alpha, \tau)=(0, \tau^{V}(\lambda, 0))$, and Bismarck, $(\alpha, \tau)=(1, \tau^{V}(\lambda, 1))=(1, 1/4)$. Note that in either case, the payroll tax is given by the induced second stage equilibrium. Individuals below this threshold prefer Beveridge to Bismarck. We also show that there exists a similarly defined threshold far-sighted individual, $\tilde{\theta}_F$. Both thresholds are functions of $\tau^{V}(\lambda, \alpha)$ and thus ultimately of λ. The political support for Beveridge is then given by

$$P(\lambda) = \lambda F(\tilde{\theta}_M) + (1-\lambda) F(\tilde{\theta}_F). \tag{9}$$

We know from the results in the previous section that $P > 1/2$ when $\lambda=0$ or when $\lambda=1$. For intermediate values the picture is more complicated. We show in Appendix A5 that $\tilde{\theta}_M$ increases with λ, while $\tilde{\theta}_F$ decreases with λ.[12] If both thresholds were affected in the same way by λ (*i.e.*, if both were increasing or decreasing) we could conclude right away that Beveridge would prevail for any mix of myopics and far-sighted. However, with $\tilde{\theta}_F$ decreasing and $\tilde{\theta}_M$ increasing, simple inspection of (9) brings out the *possibility* that P is U-shaped and drops below 1/2 for intermediate levels of λ. The numerical example reported in Table 2 shows that a vote in favor of the Bismarckian system is not only a theoretical conjecture but can effectively occur. In other words, $(\alpha, \tau)=(1, 1/4)$ can be the equilibrium of the considered sequential voting procedure for intermediate levels of λ. The example considers a Beta (2,4) distribution for θ with support [0, 16/3].

To understand the intuition behind this result, we have to keep in mind how tax rates are affected by changes in λ. Assume that we start from $\lambda=0$ and add myopic individuals. These want higher taxes than their far-sighted counterparts. Increasing λ thus moves $\tau^{V}(\lambda, 0)$ closer to

[12] More precisely, $\tilde{\theta}_M$ (resp. $\tilde{\theta}_F$) increases (resp. decreases) with λ as long as $\tau^{V}(\lambda, 0) < 1/4$, and is constant with λ when $\tau^{V}(\lambda, 0) = 1/4$.

1/4, the most-preferred value of τ of *all* the myopic (see Proposition 4). The equilibrium tax rate under Bismarck, on the other hand does not depend on λ (Proposition 4). Consequently, the political support for Beveridge among the myopic increases monotonically with λ. Let us now turn to the far-sighted. The Bismarckian equilibrium is equivalent to the laissez-faire situation for them, irrespective of λ. As λ increases, $\tau^{V}(\lambda, 0)$ moves away from $\tau^{V}(0, 0)$, which means that a majority of far sighted individual loose utility under Beveridge as λ increases.

To sum up, we have shown that modifying λ has two impacts on the majority voting result. On the one hand, λ influences the majority voting equilibrium level of the Beveridgean contribution rate: as λ increases, the Beveridgean contribution rate (weakly) increases, which increases the political support for this system among the myopics but decreases it among the far-sighted. On the other hand, λ also affects the vote share of both groups in society. When there are only myopics or only far-sighted, a majority always supports Beveridge because of its redistributive element. When both groups coexist in society, the majority voting Beveridgean contribution rate does not reflect the preferences of any single group. In that case, it is possible that a majority in society, composed of myopics and far-sighted, prefers Bismarck to Beveridge. In the numerical example reported in Table 2 a majority favors Beveridge if λ is close enough to either zero or one, and the reverse holds if both groups are important enough in society.

Let us now turn to the generosity of the pension system. Because myopic individuals tend to prefer larger payroll taxes than their far-sighted counterparts, intuition suggests that τ increases (or at least does not decrease) with the proportion of myopic individuals. This is true for any given system, Beveridgean or Bismarckian, as shown in Section 3. However, it may not be true when the pension system itself changes endogenously with λ. To study the possible monotonicity of the relationship between τ and λ we then have to take a closer look at its behavior at the levels of τ for which a switch in α occurs.

It is plain that τ cannot decrease when society moves from Beveridge to Bismarck, since the highest value of τ under Beveridge is 1/4, which corresponds to the generosity of the Bismarckian system. On the other hand, we cannot exclude that τ decreases when moving from Bismarck to Beveridge. In the example provided in Table 2, τ happens to be an increasing function of λ. In the next section we shall provide a numerical example where this is no longer the case.

5.2. Mixed societies with CES preferences

So far, the results concerning the voting equilibria in mixed societies have been obtained for the case of logarithmic utility ($\varepsilon \to 0$). We have also considered alternative levels of ε. In particular, we have studied the two extreme possibilities in the family of CES utility functions: the case of perfect substitution between consumptions in the two periods of life ($\varepsilon = 1$) and the case of no substitution at all ($\varepsilon = -\infty$). We have also looked at numerical results for additional intermediate cases and particularly for $\varepsilon = 0.75$. A detailed report of the results would be too tedious and involve too much repetition. We shall restrict ourselves to sketching the main results.[13]

With perfect substitution ($\varepsilon = 1$, and with zero interest, discount and population growth rates) there is no need for saving and transferring resources between lifetime periods has no impact on an individual's utility. Consequently, a Beveridgean pension scheme is equivalent to a standard linear income tax (à la Sheshinsky). A Bismarckian system on the other hand has no impact at all.[14] The

[13] More details are provided in a technical appendix that is available on the first author's website (http://www.idei.fr/vitae.php?i=31#id1).

[14] So that labor supply under Bismarck no longer differs between myopics and far-sighted.

Table 3
Voting equilibrium as a function of proportion of myopics, when θ is distributed over [0, 16/3] according to a Beta (2,4) and when $u(x)=x^{\varepsilon}/\varepsilon$ with $\varepsilon=0.75$

λ	$\tau^{V}(\lambda, 0)$	$\tau^{V}(\lambda, 1)$	$F(\tilde{\theta}_M)$	$F(\tilde{\theta}_F)$	Support f. Bev.	α^{V}	$\tau^{V}(\lambda, \alpha^{V})$
0	0.055	$\leq$0.25	–	0.520	0.520	0	0.055
0.02	0.066	0.168	0.418	0.516	0.515	0	0.066
0.05	0.079	0.168	0.457	0.512	0.509	0	0.079
0.10	0.096	0.168	0.492	0.506	0.504	0	0.096
0.20	0.118	0.168	0.520	0.497	0.502	0	0.118
0.25	0.127	0.168	0.527	0.494	0.502	0	0.127
0.30	0.134	0.168	0.531	0.491	0.503	0	0.134
0.40	0.145	0.168	0.536	0.487	0.506	0	0.145
0.50	0.154	0.168	0.538	0.483	0.510	0	0.154
0.75	0.170	0.168	0.539	0.477	0.523	0	0.170
0.90	0.177	0.168	0.539	0.474	0.532	0	0.177
1	0.181	0.168	0.538	–	0.538	0	0.181

Recall that from the definition of $\tilde{\theta}_M$ and $\tilde{\theta}_F$, $F(\tilde{\theta}_M)$ and $F(\tilde{\theta}_F)$ indicate the proportion of myopics and far-sighted who are in favor of Beveridge.

second stage under Beveridge is now a classical voting over a linear income tax problem yielding a positive tax as long as $\theta^{\text{med}}<\bar{\theta}$. Since far-sighted and myopics vote in the same way, the proportion of myopics has no impact. It is easily shown that a majority of individuals prefers the Beveridgean solution to the laissez-faire so that the first-stage vote *always* yields $\alpha=0$. This is because with $\theta^{\text{med}}<\bar{\theta}$ a majority gains from the redistribution implied by the pension system. To sum up, when consumption levels in the two periods are perfect substitutes, the presence of myopics has no impact. Neither the size, nor the redistributive character of the pension system is affected. This does of course not come as a surprise because with perfect substitutes it is plain that myopia does not effectively matter at all.[15] These results suggest that a Bismarckian system can only emerge if the degree of substitution between first- and second period consumption is not too high, which is empirically the most plausible case.[16]

This point is reinforced by the results, obtained for $\varepsilon=0.75$, that are reported in Table 3. Like for $\varepsilon=1$ we find that Beveridge continues to prevail for all levels of λ, at least for the considered distribution (the same as in Table 2).

With perfect complementarity, individuals aim at equating consumption (net of labor disutility) between the two periods. In the Beveridgean case, the most-preferred rate increases with ability for myopic agents, but it first increases and then decreases for the far-sighted. This situation may lead to an “ends against the middle” voting equilibrium. In the Bismarckian case, the equilibrium tax rate now depends on the parameter λ, the fraction of myopic individuals (recall that this was not the case with a logarithmic utility). The equilibrium rate under Bismarck is 1/4 for $\lambda\leqslant 1/2$ and 1/3 otherwise. Consequently we have a discontinuity. We know from Proposition 3 that for $\lambda=0$ or 1, the Beveridgean system always prevails. For an interior λ, Bismarck becomes possible and moreover, there is a discontinuity in the political support for either system as λ becomes larger than 1/2. These results are illustrated in Table 4 that is based on the same distribution of θ's as

[15] It is easy to show that the political support for Beveridge is a continuous function of ε.

[16] The empirical literature has settled on values of 0.33 or less for the intertemporal elasticity of substitution. See Auerbach and Kotlikoff (1987), Engen et al. (1994), Hubbard et al. (1995).

Table 4
Voting equilibrium as a function of proportion of myopics, when θ is distributed over [0, 16/3] according to a Beta (2,4) and when U_F=min[x, d] (perfect complements)

λ	$\tau^V(\lambda, 0)$	$\tau^V(\lambda, 1)$	$F(\tilde{\theta}_M)$	$F(\tilde{\theta}_F)$	Support f. Bev.	α^V	$\tau^V(\alpha^V, \lambda)$
0	0.044	0.250	–	0.524	0.524	0	0.044
0.03	0.056	0.250	0.073	0.520	0.507	0	0.056
0.35	0.156	0.250	0.334	0.482	0.430	1	0.250
0.50	0.195	0.250	0.428	0.466	0.447	1	0.250
0.501	0.195	0.333	0.337	0.720	0.528	0	0.195
0.55	0.207	0.333	0.360	0.697	0.512	0	0.207
0.60	0.220	0.333	0.382	0.677	0.500	0/1	0.220/0.333
0.72	0.249	0.333	0.432	0.634	0.488	1	0.333
0.75	0.260	0.333	0.448	0.620	0.491	1	0.333
0.80	0.276	0.333	0.471	0.601	0.497	1	0.333
0.95	0.311	0.333	0.515	0.562	0.518	0	0.311
1	0.320	0.333	0.525	–	0.525	0	0.320

Recall that from the definition of $\tilde{\theta}_M$ and $\tilde{\theta}_F$, $F(\tilde{\theta}_M)$ and $F(\tilde{\theta}_F)$ indicate the proportion of myopics and far-sighted who are in favor of Beveridge.

Table 2 but where utility is min[x, d]. Overall, the results pertaining to α are similar to those in the logarithmic case. However, unlike in Table 2, the size of the pension system is no longer an increasing function of the proportion of myopics.

The results of this section are summarized in the following proposition.

Proposition 5. *Assume that all individuals have CES preferences, with $u(x)=x^{\varepsilon}/\varepsilon$.*

- *(i) The impact of the proportion of myopics on the equilibrium level of α depends on the parameter ε and thus on the elasticity of substitution $\rho=1/(1-\varepsilon)$. When $\varepsilon=1$ (perfect substitutes) Beveridge prevails for any $\lambda\in[0, 1]$. Bismarck may prevail for intermediate levels of λ provided that the elasticity of substitution is not too high.*
- *(ii) When the possibility of a switch in α is accounted for, the generosity is not necessarily an increasing function of the proportion of myopics.*

6. Intermediate values of α

So far we have concentrated on extreme values of α, (namely 1 and 0) yielding a "pure" Bismarckian or Beveridgean system. An extension to a continuous choice of $\alpha\in[0, 1]$ goes beyond the scope of this paper. It raises computational problems and, more fundamentally, the very existence of a voting equilibrium is then a rather complex issue.[17]

To get some insight on the role played by the availability of intermediate systems we now introduce a third possible value of α, namely 1/2. For simplicity we assume away liquidity constraints and concentrate on logarithmic preferences. In spite of all these simplifications, analytical results are not readily available. Consequently, we restrict ourselves to a numerical example that is based on the same distribution as used in the earlier simulations. The results are given in Table 5.

[17] The difficulty is to make sure that preferences are single-peaked over α once the impact of α on the majority chosen value of τ is taken into account, *i.e.*, the single-peakedness of U with respect to α when τ is given by $\tau^V(\lambda, \alpha)$.

Table 5
Voting equilibrium as a function of the proportion of myopics, when θ is distributed over [0, 16/3] according to a Beta (2,4), $u(x)=\ln(x)$ and when people may choose between $\alpha=0$, 1/2, 1

λ	$\tau^V(\lambda, 0)$	$\tau^V(\lambda, 1/2)$	$\tau^V(\lambda, 1)$	Political support for			α^V
				$\alpha=0$	$\alpha=1/2$	$\alpha=1$	
0	0.055	0.111	0.250	0.520	0	0.480	0
0.02	0.132	0.132	0.250	0.507	0.006	0.487	0
0.05	0.089	0.162	0.250	0.489	0.019	0.492	1/2
0.10	0.123	0.208	0.250	0.467	0.040	0.493	1/2
0.16	0.164	0.259	0.250	0.457	0.051	0.492	1/2
0.275	0.669	0.262	0.250	0.424	0.084	0.492	1/2
0.5	0.250	0.260	0.250	0.460	0.056	0.484	1/2
0.597	0.250	0.258	0.250	0.475	0.054	0.471	1/2
0.99	0.250	0.250	0.250	0.537	0.002	0.460	0
1	0.250	0.250	0.250	0.539	0	0.461	0

We obtain the following main results. Individual preferences over α (with τ endogenously determined by majority voting) are always single-peaked, *i.e.*, the intermediate system is never the worst system for anybody. Consequently, we can apply the median voter theorem when choosing α, and the Condorcet winning value of α is the median among the most-preferred values of α. Observe that, although $\alpha=1/2$ is most preferred by only a small fraction of voters (mostly, if not exclusively, by myopic individuals), the intermediate system is the Condorcet winning system for a very large range of values of λ. In other words, although an intermediate system would never (in our simulation) be chosen in a three-way vote where it would be confronted to purely Beveridgean and Bismarckian systems (*i.e.*, it never has a plurality of the votes), it is very often preferred by a majority to both pure pension systems. We also obtain that the pure Bismarckian system is never a Condorcet winner, and that the Beveridgean system is preferred in homogenous societies.

7. Conclusion

In this paper we have considered a society consisting of myopic and far-sighted individuals who have to choose the type of social security they want (Bismarck or Beveridge) and the generosity of pension benefits represented by the payroll tax rate. Myopic individuals act myopically when choosing private saving and labor supply. Yet, when they vote on the size of the pension system (the payroll tax) and possibly on the Bismarckian degree of this system they act rationally looking for a commitment device. The double heterogeneity (rationality and productivity) along with the two dimensions that characterize a pension scheme make majority voting rather complex. We focus our attention on a sequential voting procedure where the determination of the Bismarckian factor precedes that of the tax rate. The second stage of this procedure is in itself already quite complex. For example, whereas the productive far-sighted tend to vote for a zero tax, productive myopic will surely vote for a positive tax. Furthermore, the poor (and liquidity constrained) far-sighted have (over some range) the same voting behavior as their myopic counterparts. This implies interesting coalitions and in some cases "ends against the middle" type of equilibria (vote on the payroll tax for a given α).

The challenging and most interesting issue is the determination of the degree of redistribution operated through the pension system. We show that when there are only individuals of a single type (far-sighted or myopic) a majority of voters prefer a Beveridgean pension system. However, when both types of agents coexist, it may be the case that a majority of voters prefer Bismarck to Beveridge. This is only possible when the degree of substitution between first and second period consumption is not too high. When they do occur, switches from Bismarck to Beveridge in turn explain the surprising result that the generosity of the pension system does not always increase with the proportion of myopics.

Are these results consistent with what we observe? Testing myopia is not an easy task. For instance, Hall (1998) states that "panel data on consumption show remarkably little difference between the consistent and inconsistent cases. Both result in similar Euler equations". Absent straightforward evidence on myopia there is, in contrast, some evidence on the generosity and on the contributive character of pension systems. It would seem that countries which prefer a Beveridgean system as opposed to a Bismarckian one tend to have a relatively small pension system (here a low payroll tax rate).[18] Observe that, in our model, the equilibrium Bismarckian tax rate is larger than the Beveridgean one *only if* two conditions are simultaneously satisfied: first, the intertemporal elasticity of substitution is lower than one (this seems empirically validated, as mentioned in Subsection 5.2) and, second, there are enough myopic individuals in society. In other words, we obtain that myopia is not only consistent with the empirical correlation between generosity and redistribution, but that it is a necessary ingredient for this relationship to emerge.

This argument concerns only the second stage and is thus admittedly only a partial empirical validation of our model. To the extent that a good indicator of myopia is not available, it is difficult to test the main implication of our (full two-stage) model, namely that a mix of myopic and far-sighted individuals (which is a likely pattern in reality) can explain why pension systems tend to be at least partially Bismarckian. Here, our line of explanation supplements the one proposed by Conde-Ruiz and Profeta (2007), who argue that the emergence of a Bismarckian scheme is driven by the fact that rich people get better returns on the private savings market than poorer agents.

Let us finally revisit the simplifying assumptions we made and discuss their importance for our results. Quadratic disutility of labor is not crucial; what makes a difference is the quasi-linear specification that assumes away income effects.

We have assumed independence between ability and myopia. While this assumption has some empirical support (see, Arrondel et al., 2005), we could have assumed a negative correlation: less productive individuals being relatively more myopic. This would complicate the analysis but would not fundamentally change our results. We could have also adopted a positive level of $\hat{a}$ for the myopics; as long as this level is sufficiently small the qualitative results would not change. More ambitiously, one could consider a continuum of discount factors but this would have clearly made our problem intractable.

In the same line, the dichotomous choice between contributive and flat rate pensions is restrictive. One can easily guess that intermediate solutions or even solutions such as $\alpha < 0$ could emerge as it appears in our normative paper (Cremer et al., in press). Again, we did not do it for reasons of tractability, but there is no reason to believe that the qualitative nature of results would change.

Finally, we have chosen sequential voting. The sequence appears rather natural, the type of social security, contributive or not, being a more fundamental feature than its generosity.

[18] See Conde-Ruiz and Profeta (2007). However, one also has to acknowledge that this positive relation between the contributive feature (α) and the generosity of the system (τ) is far from being perfect. For example, in Europe, the Nordic countries manage to combine generosity and redistribution.

Alternative models of the political process could have been considered, the results of which cannot be anticipated. This point like the others is in our future research agenda.

Appendix A

A.1. Proof of Lemma 1

Using Eq. (4) we can now express the (flat) pension as a function of the payroll tax rate:

$$p = \tau(1-\tau)Ew^2. \tag{A1}$$

To study the savings decision, substitute ℓ_i^* and Eqs. (A.1) into (5) to obtain the "indirect" utility function:

$$v(w_i,\tau,s_i) = u\left(\frac{w_i^2(1-\tau)^2}{2} - s_i\right) + \beta_i u(s_i + \tau(1-\tau)Ew^2). \tag{A2}$$

An interior solution (with $s_i > 0$) requires $\partial v/\partial s = 0$ which for $\beta_i = 1$ implies $x_i = d_i$. In other words, the far-sighted who save do perfectly smooth their consumption over time. On the other hand,

$$\frac{\partial v(w_i,\tau,0)}{\partial s_i} = -u'\left(\frac{w_i^2(1-\tau)^2}{2}\right) + \beta_i u'(\tau(1-\tau)Ew^2) \le 0 \tag{A3}$$

yields a corner solution with $s_i = 0$ and $x_i < d_i$. This case arises for all the myopics and for the far-sighted for whom the liquidity constraint is binding (they would like to borrow against their future pensions).

Straightforward manipulation of Eqs. (A2) and (A3) then establishes the Lemma 1. □

A.2. Proof of Proposition 1

In the Beveridgean case far-sighted and myopics have the same labor supply that is given by Eq. (6). Consequently, the most-preferred tax rate is the solution to

$$\max_{\tau} u\left(\frac{w_i^2(1-\tau)^2}{2} - s_i\right) + u(s_i + \tau(1-\tau)Ew^2),$$

where s_i is given by Lemma 1. Differentiating and rearranging yields

$$\tau^*(\theta,0) = \frac{\kappa(\tau^*(\theta,0)) - \theta}{2\kappa(\tau^*(\theta,0)) - \theta}, \tag{A4}$$

where

$$\kappa(\tau) = \frac{u'(d_i)}{u'(x_i)} = \frac{u'[s_i + \tau(1-\tau)Ew^2]}{u'\left[\frac{w_i^2(1-\tau)^2}{2} - s_i\right]}$$

represents the ratio of the marginal utility of second period consumption to that of the first period consumption. This ratio is less than one for the far-sighted who are credit constrained, while it is equal to one for the far-sighted who save.

(i) Myopic individuals do not save, so that Eq. (A4) can be written as follows:

$$\theta = \frac{2\tau^*(\theta,0)}{1-\tau^*(\theta,0)}\left(\frac{1-2\tau^*(\theta,0)}{2\tau^*(\theta,0)}\right)^{1/\varepsilon}. \tag{A5}$$

For $\varepsilon=0$ (logarithmic utility), all myopic most prefer $\tau=1/4$. For $0<\varepsilon<1$, we obtain that $\partial\tau^*(\theta, 0)/\partial\theta<0$, while for $-\infty<\varepsilon<0$ we have $\partial\tau^*(\theta, 0)/\partial\theta>0$.

(ii) By Lemma 1, we have that individual $\theta=2/3$ has an optimal saving of exactly zero when $\tau=1/4$. Assume that, as we claim, $s=0$ if $\theta<2/3$. By Lemma 1, $s=0$ if $\theta<2\tau/(1-\tau)$, where $\tau=\tau^*(\theta, 0)$ is obtained from Eq. (A5). From Eq. (A5), we have that $\theta<2\tau^*(\theta, 0)/(1-\tau^*(\theta, 0))$ if $(1-2\tau^*(\theta, 0))/2\tau^*(\theta, 0)<1$. If $0<\varepsilon<1$, this inequality is satisfied if $\tau^*(\theta, 0)>1/4$, which is the case given that $\partial\tau^*(\theta, 0)/\partial\theta<0$ (see (i) above) and $\tau^*(2/3, 0)=1/4$. If $\varepsilon<0$, this inequality is satisfied if $\tau^*(\theta, 0)<1/4$, which is the case given that $\partial\tau^*(\theta, 0)/\partial\theta>0$ (see (i) above) and $\tau^*(2/3, 0)=1/4$. Far sighted who do not save and myopics have the same preferences over τ because they have the same labor supply under Beveridge.

(iii) For individuals who save, Eq. (A4) reduces to

$$\tau^*(\theta,0) = \frac{1-\theta}{2-\theta}. \tag{A6}$$

We obtain that $\tau^*(\theta, 0)$ for $2/3\leq\theta\leq1$ so that, using Lemma 1, these individuals do save at their most preferred τ. Differentiating Eq. (A6) with respect to θ then shows that the most-preferred tax rate is decreasing ($\partial\tau^*(\theta, 0)/\partial\theta<0$) over the range of θ's for which $s_i>0$ and up to $\theta=\overline{\theta}=1$. When $\theta>\overline{\theta}=1$, private saving is a better instrument than social security to transfer resources across periods. These individuals favor zero pensions and taxes.

From Eq. (A4), we see that the most-preferred contribution rate increases with κ, while κ decreases with s_i. Comparing the preferred tax rates of these two individuals, we then obtain that it is higher for the myopic than for the far-sighted who save. □

A.3. Choice of α for λ = 1 (additional cases)

We make use of the following Lemma, established by comparing Eqs. (A5) with (8) and by noting that $\tau^V(1, 1)=\tau^*(\theta, 1)$ where τ^* is the same for all θ.

Lemma 3. *The equilibrium tax rate under Bismarck is the same as the most preferred tax rate of the average income individual under Beveridge:*

$$\tau^V(1,1) = \tau^*(\overline{\theta},0).$$

This lemma will help us comparing $\tau^V(1, 0)$ and $\tau^V(1, 1)$. The remaining two cases are:

Case 2. $\varepsilon<0$

We have $\tau^V(0, 1)<\tau^V(1, 1)$ by Lemma 3 together with $\partial\tau^*(\theta, 0)/\partial\theta>0$ (so that $\theta^{med}<\overline{\theta}$ is decisive). All $\theta<\theta^{med}$ want a lower tax than the equilibrium one under Beveridge which in turn is smaller than the equilibrium tax under Bismarck. It is easy to see that they have a higher utility level under Beveridge than under Bismarck for any given tax rate τ (they benefit from redistribution). They then vote for Beveridge because they benefit from redistribution and because they get a tax which is closer to their preferred level (recall that preferences are single-peaked).

Case 3. *$0<\varepsilon<1$*

We have $\tau^{V}(0, 1)>\tau^{V}(1, 1)$, by Lemma 3 together with $\partial\tau^*(\theta, 0)/\partial\theta<0$ (so that $\theta^{med}<\overline{\theta}$ is decisive). The same reasoning as in Case 2 shows that a majority of low ability people vote for Beveridge.

A.4. Proof of Proposition 4

Proof of First part (Beveridge):

We know from Proposition 1 that all myopic and all far-sighted individuals with $\theta<2/3$ most prefer a tax rate of 1/4. When they represent a majority, *i.e.*, when $\lambda+(1-\lambda)F(2/3)\geq 1/2$, the majority voting equilibrium contribution rate is given by $\tau^{V}(\lambda, 0)=1/4$. If not, the pivotal voter, $\hat{\theta}$, is a far-sighted individual with $\hat{\theta}\in]2/3, 1[$, such that

$$\lambda + (1-\lambda)F(\hat{\theta}) = 1/2, \tag{A7}$$

whose most-preferred tax rate is specified by Eq. (A6) and equal to $(1-\hat{\theta})/(2-\hat{\theta})<1/4$. Consequently, we then have $\tau^{V}(\lambda, 0)=(1-\hat{\theta})/(2-\hat{\theta})<1/4$.[19] Observe that when $\lambda>0$, Eq. (A7) implies $\hat{\theta}<\theta^{med}$, which in turn explains that we must have $\hat{\theta}<1$. Furthermore, one can easily show that $\partial\tau^{V}/\partial\lambda\geq 0$.

Proof of Second part (Bismarck):

According to Proposition 2 all the far-sighted are indifferent between all tax rates up to 1/4, while all myopics most prefer $\tau=1/4$. Consequently, we have[20] $\tau^{V}(\lambda, 0)=1/4$ for all $\lambda\geq 0$. □

A.5. Existence and properties of $\tilde{\theta}_F$ and $\tilde{\theta}_M$

1. We start by evaluating individuals' utility levels at the (second stage) voting equilibrium.

Under Beveridge, the far-sighted who do not save (*i.e.*, with $\theta<2\tau^{V}(\lambda, 0)/[1-\tau^{V}(\lambda, 0)]$; see Lemma 1) and the myopics have the same utility given by

$$\ln\left[\frac{(1-\tau^{V}(\lambda,0))^2}{2}w_i^2\right] + \ln[\tau^{V}(\lambda,0)(1-\tau^{V}(\lambda,0))Ew^2]. \tag{A8}$$

The far-sighted who save ($\theta\geq 2\tau^{V}(\lambda, 0)/(1-\tau^{V}(\lambda, 0))$), on the other hand, have a utility level of

$$2\ln\left[\frac{(1-\tau^{V}(\lambda,0))^2}{4}w_i^2 + \frac{\tau^{V}(\lambda,0)(1-\tau^{V}(\lambda,0))}{2}Ew^2\right]. \tag{A9}$$

[19] It is important to distinguish $\hat{\theta}$ and θ^{med}; θ^{med} is the median value of θ in the distribution while $\hat{\theta}$ is the productivity index of the pivotal voter.

[20] When $\lambda=0$, the equilibrium tax rate is not unique. However, the induced allocation is unique and we can without any loss of generality set $\tau^{V}(0, 0)=1/4$.

Under Bismarck, the utility level reached by a far-sighted individual is

$$2\ln\left(\frac{w_i^2}{4}\right), \tag{A10}$$

while the utility of myopics is given by

$$\ln\left(\frac{9w_i^2}{32}\right)+\ln\left(\frac{3w_i^2}{16}\right). \tag{A11}$$

2. We now determine the far sighted indifferent between Beveridge and Bismarck. Tedious algebra shows that

$$\ln\left[\frac{(1-\tau)^2}{2}w_i^2\right]+\ln[\tau(1-\tau)Ew^2]\geq 2\ln\left(\frac{w_i^2}{4}\right)$$

holds for all $\theta\in[0,2\tau/(1-\tau)]$ and $\tau\leq 1/4$. Consequently, the utility level specified by Eq. (A8) is at least as large as that given by Eq. (A10) so that all the far-sighted who do not save prefer Beveridge to Bismarck.

Next, determine $\overline{\theta}_F$ the threshold value of θ such that a far-sighted who saves is indifferent between Beveridge and Bismarck, which using Eqs. (A9) and (A10) requires

$$\frac{(1-\tau^{\mathrm{V}}(\lambda,0))^2}{4}w_i^2+\frac{\tau^{\mathrm{V}}(\lambda,0)(1-\tau^{\mathrm{V}}(\lambda,0))}{2}Ew^2=\frac{w_i^2}{4}.$$

Solving yields

$$\tilde{\theta}_F=\frac{2-2\tau^{\mathrm{V}}(\lambda,0)}{2-\tau^{\mathrm{V}}(\lambda,0)}, \tag{A12}$$

with all $\theta<\tilde{\theta}_F$ preferring Beveridge to Bismarck.

3. As for myopics, the productivity of a voter indifferent between the two systems is determined by setting Eq. (A8) equal to Eq. (A11). Solving for θ, we obtain

$$\tilde{\theta}_M=\frac{256}{27}(\tau^{\mathrm{V}}(\lambda,0)-3(\tau^{\mathrm{V}}(\lambda,0))^2+3(\tau^{\mathrm{V}}(\lambda,0))^3-(\tau^{\mathrm{V}}(\lambda,0))^4).$$

All myopics with $\theta<\tilde{\theta}_M$ prefer Beveridge to Bismarck while the opposite holds for $\theta>\tilde{\theta}_M$.

References

Angeletos, G.-M., Laibson, D., Repetto, A., Tobacman, J., Weinberg, S., 2001. The hyperbolic buffer stock model: calibration, simulation and empirical evaluation. Journal of Economic Perspectives 15, 47–68.

Arrondel, L., Masson, A., Verger, D., 2005. Mesurer les préférences individuelles pour le présent. Economie et Statistique 374–375, 87–124.

Auerbach, A., Kotlikoff, L., 1987. Dynamic Fiscal Policy. Cambridge University Press.

Benabou, R., Tirole, J., 2004. Willpower and personal rules. Journal of Political Economy 112, 848–886.

Boldrin, M., Rustichini, A., 2000. Political equilibria with social security. Review of Economic Dynamics 3, 41–78.

Conde-Ruiz, I., Profeta, P., 2007. The redistributive design of social security systems. Economic Journal 117, 686–712.

Cremer, H., De Donder, Ph., Maldonado, D., Pestieau, P., in press, Designing an optimal linear pension scheme with myopic and rational households.

Diamond, P., 2004. Social security. American Economic Review 94, 1–24.
Engen, E., Gale, W., Scholz, J., 1994. Do saving incentives work? Brookings Papers on Economic Activity 1, 85–180.
Hall, R., 1998. Comments on Laibson et al. (1998). Brookings Papers on Economic Activity 1, 173–177.
Hubbard, R., Skinner, J., Zeldes, S., 1995. Precautionary saving and social insurance. Journal of Political Economy 103 (2), 360–399.
Laibson, D., Repetto, A., Tobacman, J., 1998. Self-control and saving for retirement. Brookings Papers on Economic Activity 91–196.
Lindbeck, A., Persson, M., 2003. The gains from pension reform. Journal of Economic Literature 41, 74–112.
Mc Laffery, E., 2006. Behavioral economics and fundamental tax reforms. USC Law and Economics Working Paper, vol. 50.
Strotz, R., 1956. Myopia and inconsistency in dynamic utility maximization. Review of Economic Studies 23, 165–180.