Voting over the Size and Type of Social Security when some Individuals are Myopic

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Abstract

In this paper we study the determination through majority voting of a linear social security scheme with myopic agents. More precisely, society consists of rational and myopic individuals. Myopic individuals eventually regret their non-saving decisions when they find themselves with low consumption after retirement. Henceforth when voting they commit themselves into forced saving. We consider a pension scheme with two decision parameters: the generosity of the scheme and its redistributiveness. Individuals vote sequentially. We show how the introduction of myopic agents changes 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 rational or all myopic), while a less redistributive system may be chosen if society is composed of both myopic and rational agents.

Keywords: social security, myopia, dual-self model

JEL classification: H55, D91

1 Introduction

Public pension systems have three main functions. First, they force saving. Some individuals might be inclined to save less than the amount set aside through payroll taxes. Second, they redistribute income. Ideally redistribution should be implemented by income taxation on lifetime basis.

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Unfortunately, such a redistribution is rather limited and in most countries, pension systems are viewed as an effective and politically sustainable way of redistributing income in old age. Finally, public pensions provide insurance in a number of ways pertaining to health, longevity and financial risks. This paper is concerned by the first two functions, and particularly the first one. We consider a society in which coexist two types of individuals: rational ones who don't have to be forced to save and myopic ones who, ex ante, have a strong preference for the present even though, *ex post*, they would regret not to have saved enough. Individuals are also distinguished by their productivity.

We adopt a rather simple framework, namely a linear scheme with a payroll tax with uniform 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 generosity 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 don't save; yet when they vote they don't act as myopic, but 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.

People vote sequentially. They first vote on whether the pension system is Bismarckian or Beveridgean. Intermediate solution are not considered for reasons of simplicity. They then vote on the tax rate. Anticipating on the results, we reach a number of conclusions. First, whereas with homogeneous societies (only myopic or only rational) the majority always votes for a Beveridgean pension system, with mixed societies, a Bismarckian system can be desirable. Second, the tax rate is shown to increase with the proportion of myopic individuals, which is quite intuitive. Productive rational individuals vote for a zero tax which is not the case of productive myopic individuals. Third, we find cases which result into a "ends against the middle" solution.

The topic of myopia and social security has at times retained the attention of economists. Feldstein (1985) examines an overlapping generations economy with inelastic labor supply; he analyzes the welfare consequences of social security in an environment with myopic agents. His finding indicates that even then it may be optimal to have a meager social security system. His model is extended by Imohoroglu *et al.* (1999) who conclude that social security provides additional welfare for myopic agents who may regret their saving decisions when they find themselves with low consumption after retirement. There is also the recent paper by Diamond and Koszegi (2003) which stems from the recent literature dealing with hyperbolic discounting. Social security is there viewed as a commitment device. All these papers are normative.

2 Individual labor supply and saving

Rational individuals utility is given by

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

where c and d are first- and second-period consumption and ℓ is first-period labor supply. In the second period individuals are retired. This utility (1) is also that of myopic individuals *ex post.* It corresponds to their rational self. *Ex ante*, myopic totally forgo the second period and their utility is thus

$$U_M = u(c - \ell^2/2).$$

Besides this distinction individuals differ in productivity $w \in [w_-, w_+]$. The distribution of w is independent of the proportion λ of myopic individuals in the population.

In the absence of a pension system, rational individuals choose c, d and ℓ to maximize

$$u(c - \ell^2/2) + u(d).$$

subject to $c + d = w\ell$.

We suppose a zero interest rate (and zero rate of population growth). For the myopic individuals, the problem is even simpler; they choose the value of ℓ that maximizes:

$$u\left(w\ell - \ell^2/2\right).$$

We now introduce a pension system consisting of a payroll tax τ and pension benefit p_i that are equal to

$$p_i = \tau\left(\alpha w_i \ell_i + (1-\alpha)Ew\ell\right)$$

where $Ew\ell$ is the average before tax income. The parameter α is often called the Bismarckian or the contributory parameter. When $\alpha = 0$, $p = \tau u E w\ell$; namely, we have a flat rate benefit (Beveridgean) pension system. When

$\alpha = 1$, $p_i = \tau w_i \ell_i$, that is a 100% contributory system. Note that by assuming that both interest rate as population growth are zero, whether the pension are fully funded or based on the pay-as-you-go principle does not matter.

We now turn to the individuals choice of labor supply and saving if any. The problem of an individual of productivity i and of type β is simply:

$$\max_{l_i, s_i} u\left(w_i (1-\tau)\ell_i - s_i - \ell_i^2/2\right) + \beta_i u(s_i + p_i), \quad (2)$$
$$\text{such that } s_i \geq 0,$$

with $\beta_i = 0$ if he is myopic, and $\beta_i = 1$ if he is rational.

The solution depends on the link between second period consumption and labor supply/saving decisions. We now solve this problem separately for a Beveridgean and a Bismarckian system.

2.1 Beveridgean Social Security: $\alpha = 0$

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

$$\ell_i^* = w_i (1-\tau), \quad (3)$$

and the Beveridgean pension is

$$p = \tau (1-\tau) Ew^2. \quad (4)$$

There is no difference between myopic and rational individuals since we assume away any income effect.

We now turn to the individual saving decision.

The (perceived) indirect utility function of an individual can be written as

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

We distinguish two possibilities: zero saving or positive saving.

- $s_i = 0$ for
$$\frac{\partial v(w_i, \tau, s_i)}{\partial s_i} = -u'\left(\frac{w_i^2 (1-\tau)^2}{2}\right) + \beta_i u'\left(\tau(1-\tau) Ew^2\right) < 0$$
This is verified for $\beta_i = 0$ (namely for the myopic) and for the poor rationals with $\beta_i = 1$ and $\theta < \dfrac{2\tau}{1-\tau}$ where $\theta = \dfrac{w_i^2}{Ew^2}$

- $s_i > 0$ for $\beta_i = 1$ and $\theta > \frac{2\tau}{1-\tau}$

$$\begin{aligned} c_i &= d_i \\ \frac{w_i^2 (1-\tau)^2}{2} - \tau (1-\tau) E w^2 &= 2 s_i \end{aligned}$$

It will prove useful later on in the paper to refer to an individual not according to his ability w, but according to θ. The distribution of abilities w generates a distribution over θ, whose *cdf* is denoted by $F(\cdot)$. By definition,the average value of θ, denoted $\bar{\theta}$, equals 1. We denote its median by θ^{med} and assume that $\theta^{med} < \bar{\theta}$, which is implied by the standard property $w^{med} < \bar{w}$.

To sum up, with a flat rate pension myopic as well as low ability rational individuals do not save; high ability rational save and equalize marginal utility across the two periods.

2.2 Bismarckian Social Security: $\alpha = 1$

The individual problem is now:

$$\begin{aligned} &\max_{l_i, s_i} \quad u\left(w_i (1-\tau) \ell_i - s_i - \ell_i^2/2\right) + \beta_i u (s_i + \tau w_i \ell_i) \\ \text{such that } s_i &\geq 0, \end{aligned}$$

We distinguish three cases for the optimal labor supply

$$\begin{aligned} \ell_i^* &= w_i (1-\tau) \text{ if } \beta_i = 0, \\ \ell_i^* &= w_i \text{ if } \beta_i = 1 \text{ and } s_i > 0, \\ \ell_i^* &= w_i \left(1 - \tau \left(1 - \frac{u'(p_i)}{u'(c_i)}\right)\right) \text{ if } \beta_i = 1 \text{ and } s_i = 0. \end{aligned}$$

Rationals who save see the link between pension and labor income so their labor supply is not distorted. Labor supply of myopic is distorted as in the Beveridgean case. Rationals who do not save put a lower weight on second period consumption (because of lower marginal utility from consumption) and are in between the other two categories in terms of labor supply. Sharp contrasts with Beveridgean where labor supply was similarly distorted for myopic and rational.

As to the individual saving decision, we again distinguish between two cases:

- $s_i > 0$ for all w_i if $\beta_i = 1$ and $\tau < 1/4$. This comes from the FOC of the rationals, which is:

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

  or $s_i = \dfrac{w_i^2}{4}(1-4\tau) > 0$.

- $s_i = 0$ for all w_i if $\beta_i = 1$ and $\tau > 1/4$ or if $\beta_i = 0$.

As it appears, there is no minimum productivity required for rationals to save. Social security and the private market have the same actuarially fair return. As long as $\tau < 1/4$, social security perfectly crowds out private saving which remains positive. For $\tau > 1/4$, nobody saves. At $\tau = 1/4$, income (including disutility from labor) is perfectly smoothed across the two periods.

We now move backward one stage and study the majority voting equilibrium for the contribution rate in both the Bismarckian and Beveridgean systems.

3 Individuals' most preferred contribution rate

We denote by $\tau^*(\theta, \alpha)$ the most preferred contribution rate of individual θ given the type of social security system α. We first study Beveridge and then move to Bismarck ($\alpha = 1$) and naturally distinguish between myopic and rational agents. Remember that when voting the myopics adopt the same preferences as the rational knowing that thy don't save and that their labor supply is chosen with $\beta = 0$.

3.1 Beveridgean case

We first look at the individual's optimization problem which implies choosing:

$$\tau^*(\theta, 0) = \arg\max_{\tau} \; u\left(\frac{w_i^2 (1-\tau)^2}{2} - s_i\right) + u\left(s_i + \tau (1-\tau) E w^2\right).$$

Namely,

$$\tau^*(\theta, 0) = \frac{\kappa(\tau^*(\theta, 0)) - \theta}{2\kappa(\tau^*(\theta, 0)) - \theta} \tag{5}$$

with

$$\begin{aligned}
\kappa(\tau^*(\theta,0)) &= \frac{u'(s_i + \tau^*(\theta,0)\,(1-\tau^*(\theta,0))\,Ew^2)}{u'(\dfrac{w_i^2\,(1-\tau^*(\theta,0))^2}{2} - s_i)} \\
&= 1 \text{ if } s_i > 0 \\
&< 1 \text{ if } s_i = 0.
\end{aligned}$$

This expression $\kappa(\tau^*)$ represents the ratio of the marginal utility of second period consumption to that of the first period consumption. It is less than 1 in case of liquidity constraint.

To understand equation (5), first observe that it boils down to

$$\tau^*(\theta,0) = \frac{1-\theta}{2-\theta} \tag{6}$$

for an individual who saves. In that case, $\partial\tau^*(\theta,0)/\partial\theta < 0$ up to $\bar{\theta} = 1$, from where $\tau^*(\theta,0) = 0$. The intuition is straightforward: individuals with $\theta < 1$ gain from the social security system, because of the redistribution it entails. Their preferred contribution rate trades off gains from redistribution and distortion effects from taxation, so that τ^* decreases with individual productivity. When $\theta > 1$, private saving is a better instrument than social security to transfer resources towards the second period. They thus want to get rid of social security.

We then compare the most preferred tax rate of two individuals with the same productivity, one being a rational who saves and the other one being myopic. Take any individual with $\theta > 2/3$. From (6), we know that this individual most preferred contribution rate is lower than $1/4$. Moreover, since $\theta > 2\tau/(1-\tau)$ is satisfied with $\theta > 2/3$ and $\tau < 1/4$, such an individual will indeed save at his most preferred contribution rate. On the other hand, a myopic individual with the same θ will not save, although he should: we then have that $\kappa > 1$ for this myopic individual. From equation (5), we see that the most preferred contribution rate increases with κ. Comparing the contribution rates of these two individuals, we then obtain that it is higher for the myopic than for the rational (assessing that the latter is not liquidity constraint). Intuitively, the myopic anticipates when voting over τ that he will not save enough, and he compensates this by increasing forced saving through the social security scheme.

Observe that the most preferred contribution rate is the same for myopic and rational individuals (of a given θ) if the latter is credit constrained. Also, the most preferred contribution rate does not depend on the proportion of myopic individuals in society: this is due to the fact that labor supply is similarly distorted for both types of agents in the Beveridgean system, so that the tax base upon which pension is based depends only on the contribution rate.

Finally, it is not possible to state in general whether the most preferred contribution rate is monotone with θ for the non-savers (myopics or credit-constrained rationals). This is due to the fact that increasing θ has two effects on $\tau^*(\theta, 0)$. On the first hand, increasing θ for a given κ decreases the most preferred tax rate: a richer individual benefits less from the redistribution embedded in the Beveridgean program. On the other hand, increasing θ also increases κ, which increases $\tau^*(\theta, 0)$, other things equal: 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.

Whether one effect is greater than the other depends on the utility function and more precisely on the elasticity of substitution across periods. To go beyond this indeterminacy, we will restrict ourselves in the rest of this paper to the family of utility functions exhibiting a constant elasticity of substitution:

$$u(x) = \frac{x^\varepsilon}{\varepsilon}. \tag{7}$$

In that case, the FOC for the most preferred τ of an individual θ who does not save is given implicitly by

$$\theta^\varepsilon == \left(\frac{2\tau^*(\theta, 0)}{1 - \tau^*(\theta, 0)}\right)^\varepsilon \frac{1 - 2\tau^*(\theta, 0)}{2\tau^*(\theta, 0)}. \tag{8}$$

First observe that equations (6) and (8) are both satisfied when $\theta = 2/3$ and $\tau = 1/4$, whatever the value of ε. Those who save at their most preferred value of τ are the rationals with $\theta > 2/3$. As for the non savers, their behavior depends on the value of eps. For $\varepsilon = 0$ (logarithmic utility), all non savers most prefer $\tau = 1/4$. For $0 < \varepsilon < 1$, we obtain that $\dfrac{\partial \tau^*(\theta, 0)}{\partial \theta} < 0$ for the non savers, while for $-\infty < \varepsilon < 0$, $\dfrac{\partial \tau^*(\theta, 0)}{\partial \theta} > 0$ for the non savers. These 3 cases are summarized in Figures 1 to 3.

[Insert Figures 1, 2 and 3 about here]

When ε is positive, it is easy to substitute resources across periods. Accordingly, the total income received over the two periods matters more, and the redistributive effect of increasing θ is large: the most preferred τ decreases with θ. When ε is negative, substitution across periods is difficult, Most preferred value of ζ as a function of θ under Beveridgean scheme

Figure 1 : $\varepsilon = 0$ so that $u(x) = \log x$

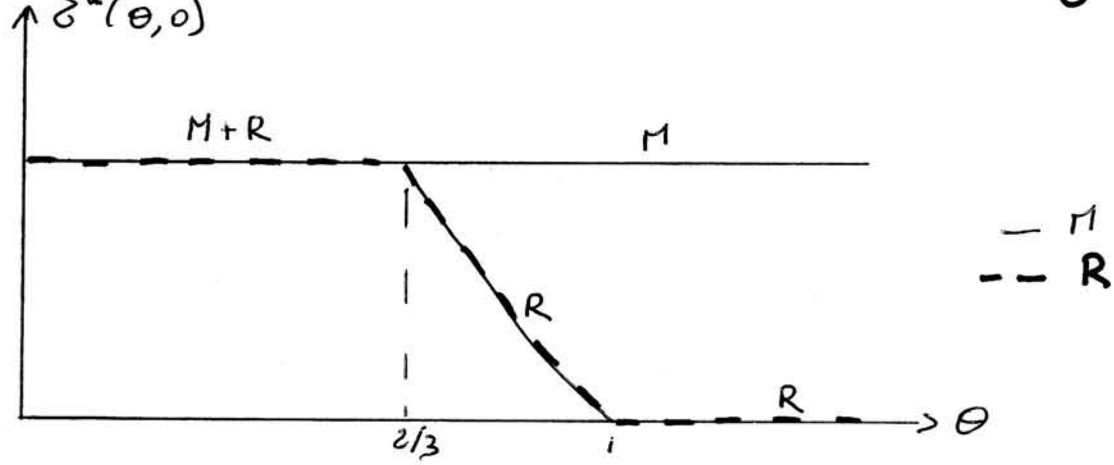


Figure 2 : $\varepsilon < 0$

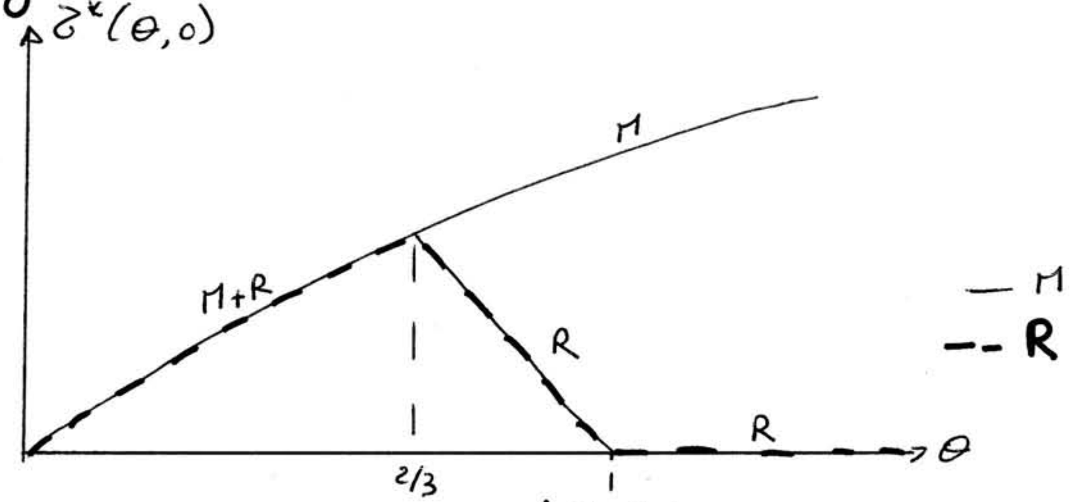
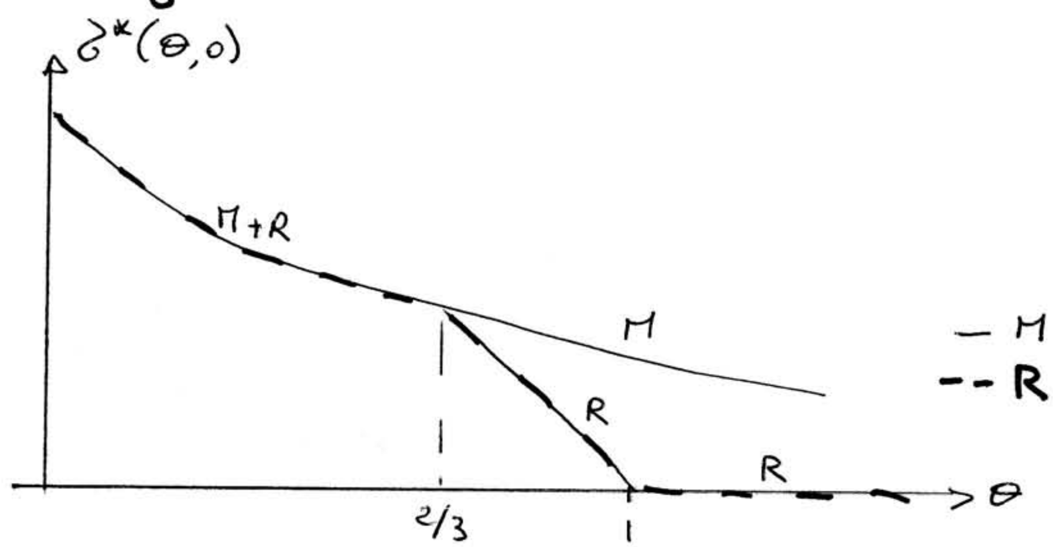


Figure 3 : $0 < \varepsilon < 1$



the marginal utility of consumption effect is bigger and hence the most preferred contribution rate increases with θ. For $\varepsilon = 0$, both effects perfectly cancel out so that the most preferred contribution rate is the same for all non savers.

It can be shown that the utility is concave in τ (with the endogenous saving decision, depending on the value of τ, so that we can apply the usual median voter theorem in the rest of the paper.

3.2 Bismarckian system

For the rational, there is perfect crowding out between social security 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 to the myopic, we have

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

so the denied tax rate is

$$\tau = \frac{u'(d_i) - u'(x_i)}{2u'(d_i) - u'(x_i)}$$

where $x_i = c_i - \ell_i^2/2$ and $d_i < x_i$ because of the tax distortion.

With the above inelastic utility, $\tau^*(\theta, 1)$ is independent of θ for the myopics. Table 1 gives the denied tax rate for different values of ε.

Table 1: Most-preferred contribution rate of myopics under Bismarck

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

We should remember that the elasticity of substitution is given by $1/(1-\varepsilon)$. 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. Saving then becomes inefficient because of the tax distortion. His most preferred tax rate tends towards zero.

From now on, we will have to specify a particular utility function. We first concentrate on the case where $u(x) = Log(x)$, i.e. where ε tends toward zero in the CES utility function family (7). We then study two extreme possibilities in the family of CES utility functions: the case of perfect substitution between consumptions in the two period of life ($\varepsilon = 1$) and the case of zero substitution ($\varepsilon = -\infty$). In all cases, our objective is to show how the majority chosen pension system (α,τ) varies when the proportion of myopic individuals changes.

4 Logarithmic utility function and majority voting

We assume that $u(x) = Log(x)$ and that the distribution of (square) abilities is positively skewed, with the median lower than the average ($\theta^{med} < \bar{\theta}$). The majority voting equilibrium contribution rate is denoted by $\tau^V(\alpha, \lambda)$, where $\lambda \in [0, 1]$ denotes the fraction of myopic individuals. We first look at the majority voting equilibrium contribution rate in a Beveridgean system, before turning to the Bismarckian system. Then, we look at the result of a vote between Beveridge and Bismarck as a function of the proportion of myopics in society.

4.1 Majority voting equilibrium contribution rate in a Beveridgean system

All myopics and all rationals with $\theta < 2/3$ most prefer a contribution rate of 1/4. If they represent a majority ($\lambda + (1-\lambda)F(2/3) \geq 1/2$), the majority voting equilibrium contribution rate $\tau^V(0, \lambda) = 1/4$. If not, we have (see equation (6)) $0 < \tau^V(0, \lambda) = (1-\hat{\theta})/(2-\hat{\theta}) < 1/4$, where the median voter

$\hat{\theta}$ is a rational agent with $\hat{\theta} \in]2/3, 1[$.[1] To summarize,

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

$$\text{where } \lambda + (1-\lambda)F(\hat{\theta}) = 1/2.$$

The majority equilibrium tax rate is then weakly increasing in λ.

The utility of a rational agent who does not save ($\theta < 2\tau^V(0,\lambda)/(1-\tau^V(0,\lambda))$) or that of a myopic agent is

$$Log(\frac{\left(1-\tau^V(0,\lambda)\right)^2}{2}w_i^2) + Log(\tau^V(0,\lambda)(1-\tau^V(0,\lambda))Ew^2).$$

In the case of a rational who saves ($\theta \geq 2\tau^V(0,\lambda)/(1-\tau^V(0,\lambda))$), his utility is

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

4.2 Majority voting equilibrium contribution rate in a Bismarckian system

All rational individuals are indifferent between any contribution rate lower than 1/4 (see section 3.2), while all myopics most prefer $\tau = 1/4$. The majority voting value τ is then 25% as soon as $\lambda > 0$. The utility of rational individuals is

$$2Log(\frac{w_i^2}{4}),$$

while the utility of myopics is

$$Log(\frac{9w_i^2}{32}) + Log(\frac{3w_i^2}{16}) = \log\frac{3}{2} + 2\log\left(\frac{3w_i^2}{16}\right).$$

4.3 Voting over Beveridge vs Bismarck

We start with the preferences of rationals for the two systems before turning to the myopics. We then analyze which among the two systems gets a majority of votes, as a function of the proportion of myopics.

[1] 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 median voter. They clearly differ in the "ends against the middle" case.

4.3.1 Preferences of rationals

Tedious algebra shows that all rationals who do not save prefer Beveridge to Bismarck, i.e. that

$$Log(\frac{\left(1-\tau^V(0,\lambda)\right)^2}{2}w_i^2) + Log(\tau^V(0,\lambda)(1-\tau^V(0,\lambda))Ew^2) \geq 2Log(\frac{w_i^2}{4}),$$

for all $\theta \in [0, 2\tau^V(0,\lambda)/(1-\tau^V(0,\lambda))]$ and $\tau^V(0,\lambda) \leq 1/4$.

We then compute the threshold value of θ a saver who is indifferent between Beveridge and Bismarck:

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

This threshold is denoted by $\tilde{\theta}_R$:

$$\tilde{\theta}_R = \frac{2-2\tau^V(0,\lambda)}{2-\tau^V(0,\lambda)},\ 0 < \tau^V(0,\lambda) \leq 1/4, \tag{9}$$

with all $\theta < \tilde{\theta}_R$ preferring Beveridge to Bismarck. The value of $\tilde{\theta}_R$ as a function of $\tau^V(0,\lambda)$ is depicted on Figure 4 (curve labeled R); it decreases with τ, and goes from 1 for τ arbitrary small to 6/7 when τ=1/4.

[Insert Figure 4 about here]

The intuition for this relation is straightforward. When $\tau^V(0,\lambda)$ equals zero, the two systems are totally identical for rationals. Increasing $\tau^V(0,\lambda)$ introduces redistribution from high to low incomes and thus benefits low income. On the other hand, this redistribution generates distortions in labor supply. When $\tau^V(0,\lambda)$ is arbitrary small, these distortions are of second order, and all individuals with a square ability lower than the average square ability prefer Beveridge to Bismarck. With a labor supply distortion proportional to the square of the Beveridgean contribution rate, increasing $\tau^V(0,\lambda)$ results in a decrease in $\tilde{\theta}_R$: individuals with square abilities slightly lower than the average shift their preference towards Bismarck because of the increasing distortions generated by the Beveridgean system.

4.3.2 Preferences of myopics

As for myopics, the productivity of the voter indifferent between the two systems is obtained by solving

$$\begin{aligned} Log(\frac{9w_i^2}{32}) + Log(\frac{3w_i^2}{16}) &= Log(\frac{\left(1-\tau^V(0,\lambda)\right)^2}{2}w_i^2) \\ &\quad + Log(\tau^V(0,\lambda)(1-\tau^V(0,\lambda))Ew^2), \end{aligned}$$

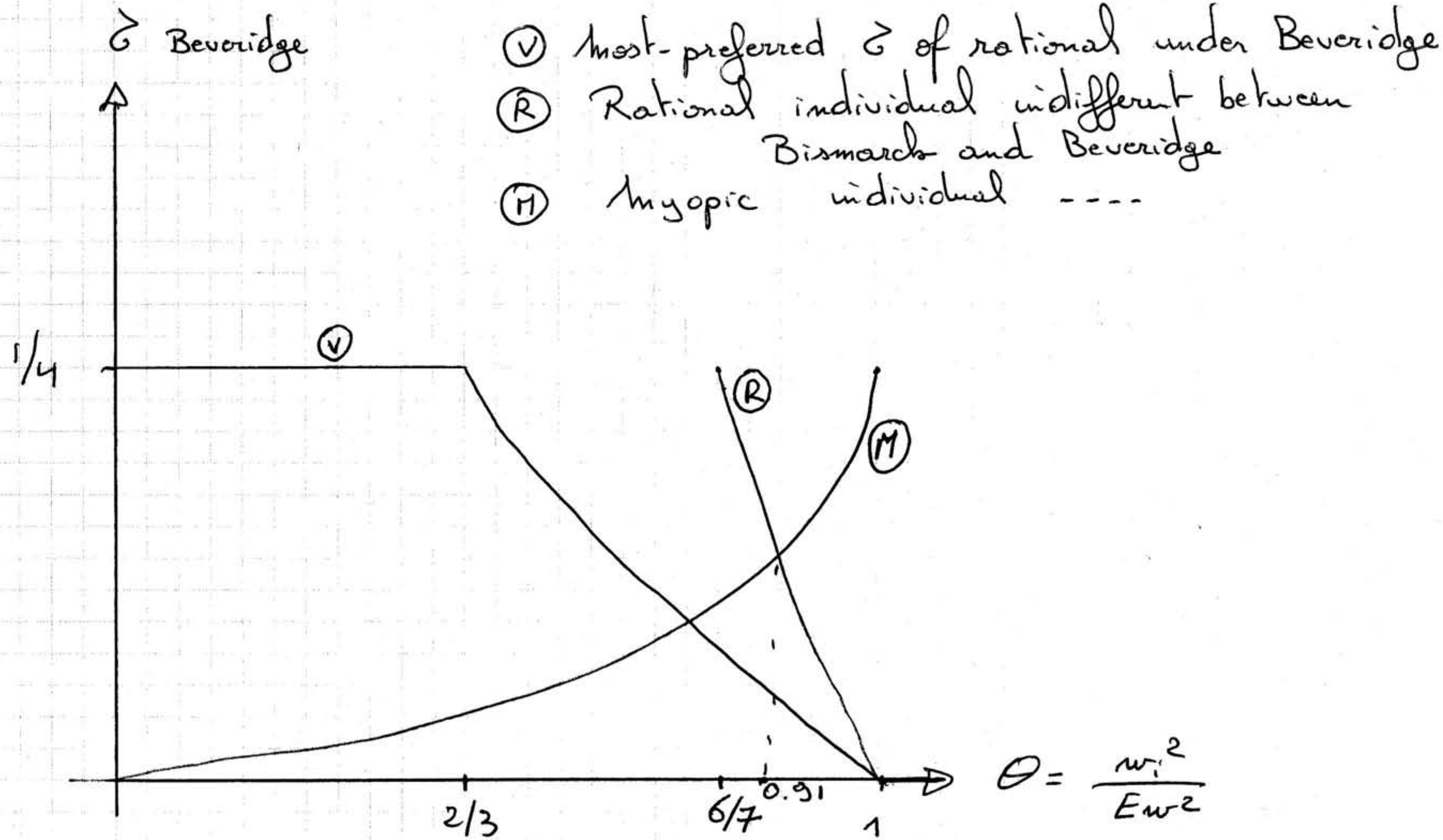

τ Beveridge
V most-preferred τ of rational under Beveridge
R Rational individual indifferent between Bismarck and Beveridge
M Myopic individual
1/4
V
R
M
2/3
6/7
0.91
1
θ = w_i^2 / Ew^2

Figure 4

where the left hand side is the utility attained under the Bismarckian system and $\tau^V(1,\lambda) = 1/4$ while the right hand side gives the utility level under Beveridge. Solving for θ, we obtain

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

All myopics with $\theta < \tilde{\theta}_M$ prefer Beveridge to Bismarck while the opposite holds for $\theta > \tilde{\theta}_M$. The value of $\tilde{\theta}_M$ as a function of $\tau^V(0,\lambda)$ is depicted on Figure 4 (curve labeled M); it is increasing in $\tau^V(0,\lambda)$ and goes from zero when $\tau^V(0,\lambda) = 0$ to 1 when $\tau^V(0,\lambda) = 1/4$.

The reason why $\tilde{\theta}_M$ increases with $\tau^V(0,\lambda)$ is as follows. When $\tau^V(0,\lambda) = 1/4$, the contribution rates are the same in both systems, and myopic individuals whose square ability is lower than the average support Beveridge because they benefit from redistribution. Observe that, unlike for rationals, the distortion in the Beveridgean system does not affect the choice of the myopic agents. Their labor supply is equally distorted in both systems, while rationals' labor supply is not distorted under Bismarck. As $\tau^V(0,\lambda)$ decreases from 1/4, we move away from the most-preferred value of the contribution rate of all myopics, which means that the Beveridgean system gets less and less attractive for them, and accordingly the indifferent myopic's θ value decreases. When $\tau^V(0,\lambda)$ reaches zero, all myopics strictly prefer the Bismarckian system, since they get no income in the Beveridgean system, which gives a utility level of minus infinity with the logarithmic utility function.

The two kinds of voters thus react in opposite directions to a variation in $\tau^V(0,\lambda)$: an increase in $\tau^V(0,\lambda) \in [0,1/4[$ increases the political support for Beveridge among the myopics but decreases it among the rationals. Observe also that $\tilde{\theta}_M < \tilde{\theta}_R$ for low values of $\tau^V(0,\lambda)$ while the reverse holds for higher values of $\tau^V(0,\lambda)$: depending on the value of $\tau^V(0,\lambda)$, the proportion of myopics in favor of Beveridge may be bigger or lower than among rationals.

4.3.3 Majority voting results

We can now look at the result of a majority vote over α, given λ. If $\lambda = 0$, there is no myopic individual. We use the fact that the Beveridgean contribution rate is the one most preferred by θ^{med} among rationals to prove that a majority always prefers Beveridge to Bismarck. In the case where $\theta^{med} \leq 2/3$, we have that $\tau^V(0,0) = 1/4$ and $\tilde{\theta}_R = 6/7 > \theta^{med}$. In the case where $2/3 < \theta^{med} \leq 1$, we have that $\tau^V(0,0) = (1-\theta^{med})/(2-\theta^{med})$ and, from (9), that $\tilde{\theta}_R = 2(3-\theta^{med}) > \theta^{med}$ in the relevant range of θ^{med}.

This proof can be made easier geometrically, by looking at two curves in the $(\theta,\, \tau)$ space, with $0 \leq \tau \leq 1/4$: the first one (labelled V in Figure 4) is $\tau^*(\theta, 0)$ (for the rationals) and the second (labelled R) is $\tilde{\theta}_R$. For any $\theta^{med} < 1$, the V curve gives the majority voting equilibrium Beveridgean contribution rate. Looking horizontally, the R curve gives the identity of the voter indifferent between this Beveridgean contribution rate and a Bismarckian system (whose majority voting equilibrium contribution rate is 1/4). A majority of voters prefer Beveridge if the R curve is everywhere to the right of the V curve, meaning if the indifferent voter type is to the right of the median one, i.e. if

$$\frac{2-2\tau}{2-\tau} \geq \frac{1-2\tau}{1-\tau}$$

for $0 \leq \tau \leq 1/4$. This geometrical argument easily shows that there is always a majority in favor of Beveridge, consisting of all the individuals who would have wanted a (weakly) higher Beveridgean contribution rate (at least one half of the population, since this rate is chosen by majority voting) plus some rationals with less-than-average square abilities. We now look at what happens as the proportion of myopic individuals increases.

As λ increases, $\tau^V(0, \lambda)$ weakly increases, which increases the political support for Beveridge among the myopics but decreases it among the rationals. Observe that, when λ is positive, the value of $\tau^V(0, \lambda)$ is the one most-preferred by the median in all the population and not the median among the rationals. If $\tau^V(0, \lambda)$ <1/4, this median in the population is a rational individual, but he has an ability that is lower than the median ability among rationals. One can thus not replicate the argument above, and it may be the case that a minority of rational individuals prefer Beveridge when $\lambda > 0$. A minority of myopics will vote for Beveridge if $\tau^V(0, \lambda)$ is low enough, i.e. if the median in the population is a rational with a square ability close enough to the average square ability. We then cannot exclude the case where a majority in the population favors the Bismarckian system for some interior values of λ.

Observe that there exists a threshold value of λ, strictly lower than one, above which $\tau^V(0, \lambda) = 1/4$. Once this threshold is reached, further increases in λ do not affect the majority voting equilibrium level of the Beveridgean contribution rate, but only the vote share of the myopics and rationals. When $\tau^V(0, \lambda) = 1/4$, a majority of myopics favor Beveridge. As for rationals, it depends whether $F(2/3)$ is lower or greater than 1/2. It is thus possible that a majority in the population favors Bismarck even when λ is high enough so that $\tau^V(0, \lambda) = 1/4$.

Finally, if λ is sufficiently high, a majority in the population always prefer

Beveridge to Bismarck. This is especially the case if $\lambda = 1$. In that case, we have that the majority voting equilibrium contribution rate is the same in both systems: $\tau^V(0,1) = \tau^V(1,1) = 1/4$. When voting over Bismarck vs Beveridge, all agents forecast that the same contribution rate will emerge in both systems. The only difference is that the pension is based on one's own income in the case of Bismarck and one the average income in the case of Beveridge. All individuals with an income lower than average ($\theta < 1$) prefer Beveridge while the richer-than-average individuals prefer Bismarck.

We then obtain the following result.

Result 1 *Assume that society is composed of a fraction λ $(1-\lambda)$ of myopic (rational) agents, that both kinds of agents have the same logarithmic utility function and the same positively skewed distribution of (square) abilities. Then a majority of voters prefer a Beveridgean social security system if* $\lambda = \{0,1\}$*. If both types of agents coexist, it may be the case that a majority of voters prefer Bismarck to Beveridge.*

The intuition behind Result 1 is 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 rationals. On the other hand, λ also affects the vote share of both groups in society. When there are only myopics or only rationals, 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 rationals, prefer Bismarck to Beveridge. The numerical example reported in Table 2 indeed shows that a majority favors Beveridge if λ is close enough to either zero or one, and that the reverse holds if both groups are important enough in society.

λ	$\hat{\theta}$	$\tau^V(0,\lambda)$	θ_M	$F(\theta_M)$	θ_R	$F(\theta_R)$	Support for Beveridge	α^V
0	0.941	0.055	-	-	0.972	0.520	0.520	0
0.02	0.926	0.069	0.525	0.213	0.964	0.516	0.509	0
0.05	0.903	0.089	0.636	0.287	0.954	0.508	0.497	1
0.10	0.860	0.123	0.785	0.392	0.935	0.495	0.485	1
0.125	0.838	0.140	0.844	0.433	0.925	0.489	0.482	1
0.250	0.702	0.230	0.995	0.536	0.870	0.451	0.472	1
0.275	0.669	0.249	0.999	0.539	0.858	0.443	0.469	1
0.277	[0,2/3]	0.250	1	0.539	0.857	0.442	0.469	1
0.5	-	0.250	1	0.539	0.857	0.442	0.491	1
0.597	-	0.250	1	0.539	0.857	0.442	0.500	0/1
0.99	-	0.250	1	0.539	0.857	0.442	0.538	0
1	-	0.250	1	0.539	0.857	0.442	0.539	0

Table 2: Majority voting result as a function of proportion of myopics
Logarithmic utility function
w_i^2 distributed according to Beta (2,4) with on $[0, 4]$

In the appendix we look at two other cases, the two extreme possibilities in the family of CES utility functions: the case of perfect substitution between consumptions in the two period of life ($\varepsilon = 1$) and the case of no substitution at all ($\varepsilon = -\infty$).

With perfect substitution there is no need for saving and the public scheme is standard linear income tax with Beveridge. With Bismarck it is irrelevant. The distortion between myopic and rational individuals disappears. With our assumption on the density of w or θ, Beveridge is to be chosen by a majority of agents.

With perfect complementarity, individuals aim at equating consumption 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 rational individuals. This situation may lead to an "ends against the middle" voting equilibrium. In the Bismarckian case, the equilibrium tax rate depends on the parameter λ, the fraction of myopic individuals. It is $1/4$ for $\lambda \leqslant 1/2$ and $1/3$ otherwise. As a result, 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 $1/2$.

5 Conclusion

In this paper we have considered a society consisting of myopic and rational 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 generosity 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 the tax rate. The second stage of this procedure is in itself already quite complex. For example, whereas productive rational individuals tend to vote for a zero tax, productive myopic will surely vote for a positive tax. Furthermore poor (and liquidity constrained) rational individuals have (over some range) the same voting behavior as their myopic counterparts. This implies interesting coalition 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 system. We show then when there are only individuals of a single type (rational or myopic) a majority of voters prefer a Beveridgean social security system. However, when both types of agents coexist, it may be the case that a majority of voters prefer Bismarck to Beveridge. This result is analogous to that obtained in the normative case wherein a utilitarian but paternalistic social planner chooses simultaneously the type and the generosity of the social security system (Cremer *et al.*, 2005).

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