On the political sustainability of redistributive social insurance systems*

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Abstract

We consider social insurance schemes with a two-part benefit formula: a flat (constant) term and a variable term which is proportional to individuals' contributions. The factor of proportionality defines the type of social insurance. We adopt a two-stage political economy approach. At the first, constitutional stage, the type of social insurance is chosen "behind the veil of ignorance", according to the Rawlsian or the utilitarian criterion. At this stage, private insurance can also be prohibited or allowed. At the second stage, tax rate and benefit level are chosen by majority voting. Three main results emerge. First, it may be appropriate to adopt a system which is less redistributive than otherwise optimal, in order to ensure political support for an adequate level of coverage in the second stage. Second, supplementary private insurance may increase the welfare of the poor, even if it is effectively bought only by the rich. Third, the case for prohibiting (supplementary) private insurance may become stronger when the efficiency of private insurance markets increases.

1 Introduction

The future of social insurance systems is a hotly debated issue among economists and non-economists alike. One of the prominent issues is that of the primary function of social insurance: just relief of poverty or, more ambitiously, reduction in the uncertainty faced by all individuals. It is often argued that the appropriate choice between these two approaches involves a tradeoff between efficiency cost (distortions) and political sustainability. The main argument in favor of the minimal view is that such a social insurance costs less, and thus requires lower payroll taxes, inducing smaller distortions. The main argument in favor of the more generous view, on the other hand, is that such a social insurance in the Bismarckian tradition concerns everyone in society, thus attracts more political support and resists better to its rolling back.

The purpose of this paper is to study how the issue of political support affects the design of social insurance systems. In particular, we want to determine, which type of social insurance system is most suitable to resist to popular pressures. We first address this problem in a setting where private insurance is potentially available, but may be prohibited.

Social insurance, such as defined here, is financed by a proportional payroll tax. It provides benefits that consist of two parts: a flat part and a variable part that is a fraction of individuals' contributions. This fraction, which we call the Bismarckian factor, defines the type of social insurance that may range from a flat-rate benefits type to a pure Bismarckian scheme whereby all benefits are proportional to individuals' contributions.

We adopt a two-stage political economy approach.[1] In the first, constitutional stage, the type of social insurance is chosen by people who are to a large extent uncertain about the implications of alternative types of social insurance for their own interests. They may therefore be guided by the kind of justifications given for utilitarianism or the original position leading to the maximin criterion. At this constitutional stage, the "behind the veil of ignorance" choice is made taking into account the fact that the actual tax rate and benefit levels will be chosen by majority voting in the second stage. In the second stage, individuals know exactly where they stand and they vote accordingly. At this stage, we adopt the median voter model.

[1] This is often called the "constitutionalist" or the "fiscal constitution" approach.

It will be shown that the political process in the second stage may have a crucial impact on the constitutional decision pertaining to the social protection system. If the tax rate could be directly controlled, our setting would call for a system with flat benefits (i.e. a Bismarckian factor set at zero). With majority voting in the second stage, on the other hand, the equilibrium tax rate is contingent on the Bismarckian factor, but this allows only for an indirect control. As a consequence, it may be appropriate to adopt a system which is less redistributive than otherwise optimal, in order to ensure political support and thus an adequate level of coverage in the second stage. The key parameters determining the equilibrium outcome are the earnings distribution and the concavity of the utility functions. The final outcome we are interested in consists of two terms: the size of the scheme which is represented by the tax rate and decided by majority voting and the redistributiveness of the scheme, denoted by the Bismarckian factor and chosen at the constitutional stage.

Whether or not private insurance is available has an important impact on the outcome. In our model, this issue is also decided constitutionally. Private insurance is assumed to be costlier than public insurance but tends to be more attractive for anyone with above-average earnings. We shall show that the (un)availability of private insurance crucially affects the nature of the voting equilibrium in the second stage. Without private insurance, the individual with the median income is necessarily pivotal, while other individuals may be pivotal when private insurance is available. Rather surprisingly it also turns out that the availability of private insurance may foster, rather than undermine the political support for social insurance. Finally, it appears that the case for prohibiting (supplementary) private insurance may become stronger when the efficiency of private insurance markets increases.

The idea that the type of social insurance has an impact on the level of political support for particular policies is not new. There is a long-standing debate regarding the relative advantages of alternative benefit formulas: not only earnings-related and flat-rate benefits but also means-tested benefits.

Political scientists such as Esping-Andersen (1990) have explored the historical roots of three social protection systems: (i) flat and means-tested benefits that are rather meager, (ii) earnings-related benefits with high taxes and (iii) flat benefits with high taxes, putting, e.g., the UK in the first, Germany in the second and Sweden in the third category. The problem facing "political economists" is to explain the emergence of such systems in a positive way. Most of the existing theoretical studies deal with the choice between flat-rate and means-tested benefits. In this choice, the flat-rate formula is that which provides the wider spread of benefits and is thus likely to attract the wider political support.

Moene and Wallerstein(1996) adopt a Rawlsian viewpoint to choose between uniform benefits and means-tested benefits. The most striking result they obtain is that when means-tested benefits are so low that the probability that the median voter will be a welfare recipient is near zero, the median voter prefers to reduce benefits to zero. They conclude: "the conservative ideal of a limited welfare state that pays benefits only to the very poor is politically unsustainable in the absence of altruistic voting" (p 20). In this literature, like in our model, voters are indeed assumed to be self-interested.[2]

To some extent, our paper is also related to another stream of literature that is concerned with the majority voting choice of public insurance contributions when private insurance is available. More generally, this line of research studies the equilibrium supply of publicly provided private goods with or without private supplements and with or without the possibility of "opting out". Epple and Romano (1996), for instance, show that a system of public provision along with private supplements is majority preferred to either a market-only or a government-only regime. Anderberg (1997) extends their model to an insurance setting with adverse selection. Compared to their work, in our paper, the possibility of supplementing social insurance by a private one is decided at the constitutional level.

Like most of the existing literature, we provide a highly stylized representation of social insurance. On the revenue side we assume a proportional payroll tax and on the expenditure side, we consider a compensation that is more or less related to contributions. The compensation is paid in the bad state of nature, in which an individual loses his earning capacity and is without resources. Such a scheme is rather close to unemployment and disability insurance and to a lesser extent to health insurance.

The rest of the paper consists of four sections. Next section presents the model. In section 3, we consider the case in which private insurance is unavailable. Section 4 deals with the case where private insurance is available

[2]De Donder and Hindricks (1998) use an alternative approach wherein both parameters, the tax rate and the means-test factor, are chosen simultaneously by majority voting. They expectedly face serious problems of indeterminacy and multiplicity of equilibria.

and thus affects the constitutional choice of social insurance. In section 6, we look at the possibility of prohibiting it at the constitutional level and we present a numerical example.

2 The basic model

The society consists of an identical number of three types of individuals. An individual of type i is characterized by his (exogenous) income level w_i, with $w_1 < w_2 < w_3$.[3] In order to focus on redistributive social insurance, we do not explicitly consider the possibility of redistributing income through an income tax.[4] However, one can interpret the w_i's as income levels after income taxation.

Individuals can be in two states of the world. In the first, they earn w_i and in the second, they have no income and must rely on insurance benefits. To keep the notation simple, we assume that they all face the probability 1/2 to be in either state.[5] Assuming further that they have identical preferences over disposable income c_i and insurance benefits b_i; their utility function is given by

$$U(c_i, b_i) = u(c_i) + u(b_i) \tag{1}$$

where u is strictly concave (and increasing). Further, we assume that the coefficient of relative risk aversion $R_r(x) = -xu''(x)/u'(x)$ is non-decreasing and larger than one.[6] Benefits $b_i = b_i^p + b_i^s$ represent the sum of private and social insurance benefits. Private benefits b_i^p are determined by an individual's contribution. Specifically, one has

$$b_i^p = \rho^p \theta_i w_i, \tag{2}$$

where $\theta_i \geq 0$ is the proportion of income invested in private insurance, while ρ^p is the rate of return of such insurance. Social insurance is financed by a

[3]Our analysis can easily be extended to the case of a continuous distribution of incomes. This does not affect the results but makes their derivation more technical and less intuitive.

[4]This would call for endogenous labor supply and would complicate the analysis.

[5]This is a stylized representation of a more complex setting in which each type i is characterized by w_i and p_i, the probability of losing his earning capacity. In such a setting, a crucial parameter is the correlation between w and p. For sickness, disability and unemployment, this is likely to be negative. In this case, one can show that the median income earner can oppose redistribution even when his income is below average income.

[6]Both of these assumptions are standard and generally considered as "realistic".

proportional payroll tax at rate $t \geq 0$ and benefits are given by

$$b_i^s = t[(1-\alpha)\overline{w} + \alpha w_i], \tag{3}$$

where $\overline{w} = (w_1+w_2+w_3)/3$ is the mean income while $\alpha \in [0,1]$ is the Bismarckian factor. Observe that (3) takes into account the budget constraint of the public sector (requiring that average contributions equal average benefits).[7] With $\alpha = 0$, social insurance is fully redistributive and everyone receives the same benefits $t\overline{w}$ (which equal the average contribution). On the other hand when $\alpha = 1$, individual benefits are equal to individual contributions and there is no redistribution of income. In reality, there is no country with $\alpha = 1$ or 0; what prevails is a mixture of these two canonical types of social insurance. This is why we study the possibility of α being between 0 and 1. Social benefits are then a convex combination of average and individual contributions and a higher value of α represents a *less* redistributive social insurance system.

Observe that the rate of return of private insurance is the same for all types (income levels), while social insurance implies a rate of return which is type-specific and given by:

$$\rho_i^s = [\frac{\overline{w}}{w_i}(1-\alpha) + \alpha]. \tag{4}$$

Not surprisingly, ρ_i^s is a decreasing function of w_i, unless $\alpha = 1$ ("pure" Bismarckian system). Further, one can easily verify that the "average return" of social insurance equals one (government's budget constraint).[8]

[7]When, as discussed in footnote 5, differential loss probabilities are introduced, the utility function of type i is given by:

$$U(c_i, b_i) = (1-p_i)u(c_i) + p_i u(b_i).$$

Private and social insurance benefits are now respectively determined by:

$$b_i^p = \rho^p \theta_i w_i \frac{1-p_i}{p_i},$$
$$b_i^s = t\left[(1-\alpha)\frac{\sum_k w_k(1-p_k)}{p_i} + \alpha w_i \frac{1-p_i}{p_i}\right].$$

These expressions reduce to (1)–(3) when $p_i = 1/2$.

[8]Using (4) one can easily show that $\sum_i w_i \rho_i^s = 1$.

Throughout the paper we shall assume that $\rho^p < 1$: private insurance is costlier than public insurance. This assumption may, at first, appear somewhat surprising. Many economists believe that the public sector tends to be less efficient than the private sector. This belief is one of the main rationales for privatization. However, in the case of financial intermediation, insurance and banking, one often observes that the public sector is cheaper than the private sector for two main reasons. First, social insurance is generally managed through a single administration, as opposed to private insurance which is provided by a number of companies. Consequently, social insurance benefits from sizeable scale economies. Second, the private insurance market devotes a lot of resources to advertisement, which is not the case for social insurance. These arguments are confirmed by a number of empirical studies. It is important to realize that the key efficiency enhancing feature here is the collective and "monopolistic" nature of social insurance.[9]

The arguments of the utility function can now be expressed in the following way:

$$c_i = w_i(1 - \theta_i - t) \quad \text{and} \quad b_i = w_i(\rho_i^s t + \rho_p \theta_i) \tag{5}$$

Consider an individual of wage w and assume for the time being that he can choose both the level of social protection (by setting t, for a given value of α) and his private insurance contribution, θ. This problem provides a useful benchmark for the study of voting behavior below. The linearity of expression (5) implies that he will, in general, only choose one type of insurance. Specifically, he will choose private insurance ($\theta > 0$ and $t = 0$) if $\rho^p > \rho^s$, while he prefers social protection ($t > 0$ and $\theta = 0$) in the opposite case. Recall that ρ^s (defined by (4)) decreases with w; not surprisingly, low income individuals are thus more likely to favor social protection. Furthermore, the comparison between the two rates of return depends on the value of α. In particular, when $\overline{w}/w < \rho^p < 1$, there exists an interior value of α for which $\rho_p = \rho_s$; it is easily determined from (4) and given by

$$\overline{\alpha}(w) = \frac{\rho^p w - \overline{w}}{w - \overline{w}} \tag{6}$$

[9] This issue of the excess cost associated with a privately managed insurance system has been particularly studied for social security and health care. Diamond (1992) argues that these excess costs are not negligible. Mitchell (1998) in her survey shows that they vary greatly across countries and institutional settings; see also Gouyette and Pestieau (1998).

Consequently, if $\alpha = \overline{\alpha}(w)$ individuals of income w are indifferent between the two types of protection, while all those with lower (res. higher) income levels strictly prefer social (resp. private) insurance.

For future reference note that:

$$\frac{d\overline{\alpha}}{dw} = \frac{\overline{w}(1-\rho^p)}{(w-\overline{w})^2} > 0$$

as long as $\rho^p < 1$.

3 Private insurance prohibited

We first analyze the case where private insurance is not available. The objective of this exercise is twofold. First, there are countries where social insurance, notably in the field of health care, is not allowed. Second, if the availability of private insurance decreases ex ante social welfare, its prohibition might be desirable.[10]. To deal with this issue it is of course necessary to separately analyze both cases.

3.1 Voting stage: the choice of t given α

Given α, the tax rate is chosen by majority voting. We must then identify the median voter and determine his preferred tax rate.

The preferred payroll tax rate of an individual with earnings w is given by:[11]

$$t^*(w,\alpha) = \arg\max_t u[w(1-t)] + u[t(\overline{w} + \alpha(w-\overline{w})] \tag{7}$$

For simplicity we shall often use the notation $t_i^*(\alpha) \equiv t^*(w_i, \alpha)$, $i = 1, 2, 3$ to refer to the preferred tax rates of the different types.

The first- and second-order conditions are:

$$-u'(c)w + u'(b)(\overline{w} - \alpha(\overline{w} - w)) = 0 \tag{8}$$

[10] Admittedly, redistribution is not the only and probably not the main possible argument for banning private insurance from, say, health care. Moral hazard (when private insurance covers the coinsurance rate) and adverse selection may provide alternative justifications.

[11] To write the objective function we have substituted (5) into (1) and set $\theta = 0$.

$$D = u''(c)w^2 + u''(b)(\overline{w} - \alpha(\overline{w} - w))^2 < 0 \tag{9}$$

where (9) holds for all $t \in [0, 1]$. Consequently, the objective function is concave (preferences are single-peaked) so that a majority voting equilibrium exists and is determined by the preferred tax rate of the median (pivotal) voter.

Before proceeding, two remarks about the properties of t^* are in order. First, it follows directly from (8) that

$$t^*(w, 1) = \frac{1}{2} \quad \forall w. \tag{10}$$

In words, when $\alpha = 1$ (pure Bismarckian system with no redistribution) all types have the same preferred tax rate, namely $t = 1/2$ which allows for perfect consumption smoothing across states of nature ($c = b$).

Second, differentiation of (8) yields:

$$\frac{\partial t^*}{\partial \alpha} = \frac{(\overline{w} - w)u'(b)(1 - R_r(b))}{D}. \tag{11}$$

Given our assumption on relative risk aversion ($R_r > 1$), this expression has the same sign as $\overline{w} - w$. Consequently, the preferred tax rate is a decreasing (resp. increasing) function of the Bismarckian factor for individuals with above-average (resp. below-average) incomes.[12]

We can now turn to the determination of the voting equilibrium. When t^* is a monotonic (increasing or decreasing) function of w, the median voter is simply the individual with median income (namely w_2). To check if this (sufficient) condition holds, we use the following expression, derived from (8):

$$\frac{\partial t^*}{\partial w} = \frac{\alpha u'(b)(1 - R_r(b)) - u'(c)(1 - R_r(c))}{-D} \tag{12}$$

With $D < 0$ (expression (9)), it immediately follows that (12) is positive if

$$\frac{\alpha u'(b)}{u'(c)} < \frac{1 - R_r(c)}{1 - R_r(b)} \tag{13}$$

[12] One can easily verify that a change in α creates conflicting income and substitution effects. With $R_r > 1$, the income effect dominates and this explains the relationship between α and t^*.

One can easily show that this condition is necessarily satisfied when $w > \overline{w}$. This property, along with (10) and (11) then implies that when $w_2 > \overline{w}$ one necessarily has $t_1^*(\alpha) < t_2^*(\alpha) < t_3^*(\alpha)$ for any $\alpha < 1$. When $w < \overline{w}$, (13) continues to hold (without any further restrictions required) when α is sufficiently close to 0 or 1. However, some additional technical assumptions are now required to ensure an unambiguous ranking of the different types' preferred tax rates for any value of α. These assumptions are satisfied, in particular, for the class of (exponential) utility functions we consider in the illustrations below.[13]

In what follows, we shall concentrate on the case where a median income individual is effectively the median voter so that the voting equilibrium is given by $t_2^*(\alpha)$, the preferred tax rate of type 2.

To set the grounds for the analysis of the constitutional stage, note that $t_2^*(\alpha)$ is increasing or decreasing depending on whether $w_2 < \overline{w}$ or $w_2 > \overline{w}$ (see expression (11)). In words, an increase in the Bismarckian factor yields a higher (resp. lower) equilibrium tax rate when the median income is smaller (resp. larger) than the mean income. Empirically observed income distributions typically suggest that the median income is lower than the average income. However, as noted above, when the probability of income loss is negatively correlated with income, $t_2^*(\alpha)$ can be decreasing even when $w_2 < \overline{w}$.[14] Furthermore, when dealing with voting, abstention can imply that the median income of those voting effectively be higher than the average income. Consequently, the results that emerge when the pivotal voter has above-average income may be of some relevance and we shall continue to consider both case.

Figures 1 and 2 summarize the main results of this section; they depict the profiles of preferred tax rates for both of the considered cases. It might appear surprising to find that higher income people prefer higher tax rate. However, one has to keep in mind that social insurance is here the only source of income in the bad state of nature. If the utility function is sufficiently concave, high income individuals will then prefer a higher value of b than poor individuals, even though they pay a higher price for this coverage.[15]

[13] Utility functions with constant relative risk aversion provide another example.

[14] See footnote 5.

[15] Too illustrate this consider the case of an "extremely" concave utility function implying

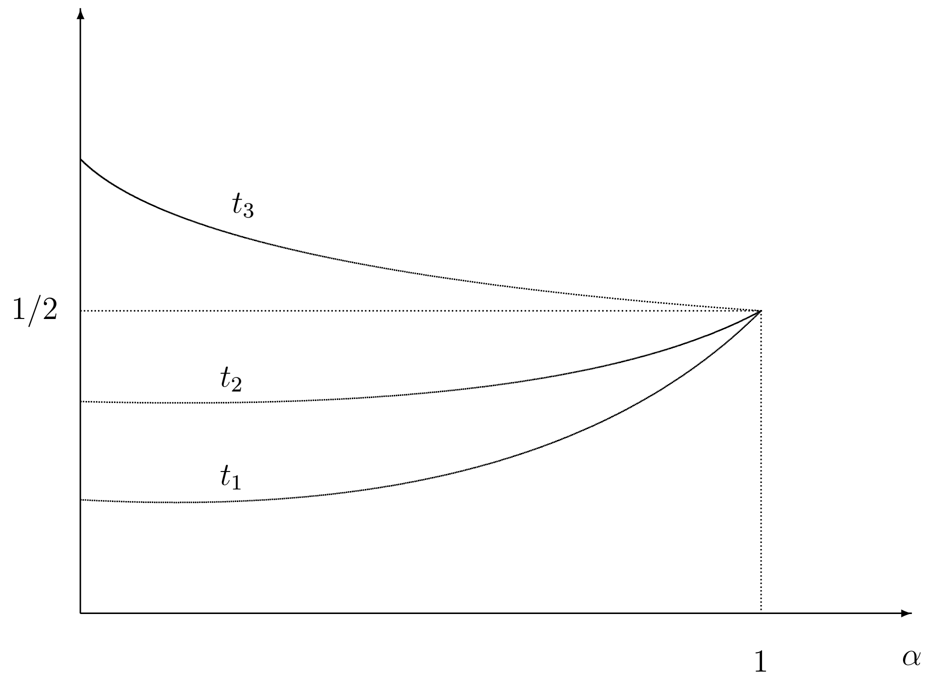

Figure 1: Profile of preferred tax rates for $w_2 < \overline{w}$

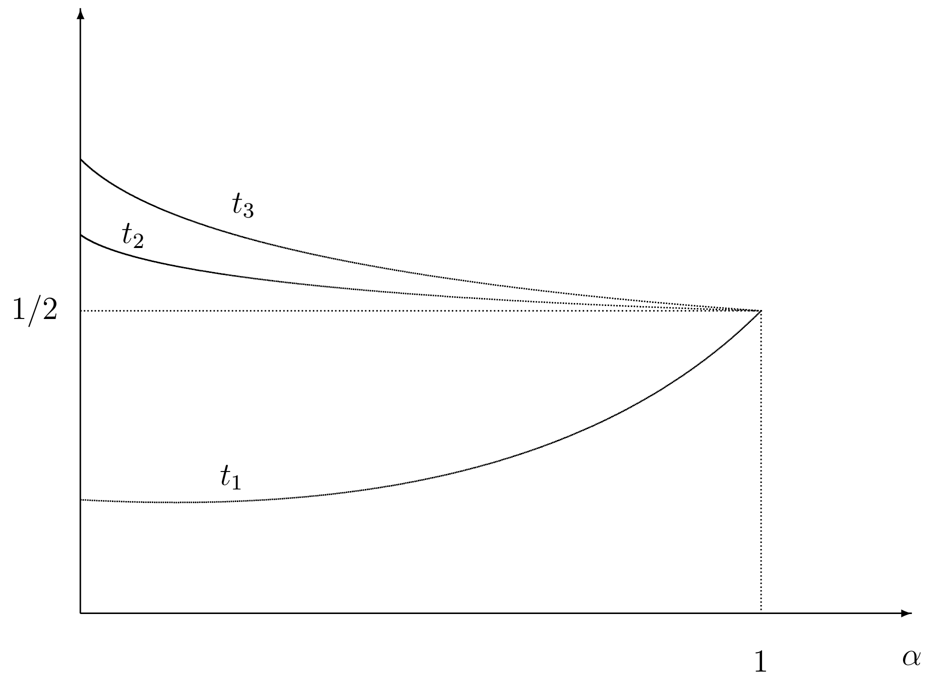

Figure 2: Profile of preferred tax rates for $w_2 > \overline{w}$

3.2 Constitutional stage: Rawlsian objective

We now turn to the constitutional stage at which α is determined. Utility levels are evaluated at the second-stage voting equilibrium induced by the considered value of α. Some additional notation is needed. First, define

$$V_i^n(\alpha,t) = u[w_i(1-t)] + u[t(\overline{w} + \alpha(w_i - \overline{w}))], \quad i = 1,2,3, \tag{14}$$

which specifies the utility of a type i individual as a function of α and t. The index n is used to point out that there is no private insurance. The relevant utility level to be considered at the constitutional stage is obtained by evaluating (14) at $t_2^*(\alpha)$ (the voting equilibrium given by the preferred tax rate of the median voter). Formally, we define $v_i^n(\alpha) = V_i^n(\alpha, t_2^*(\alpha))$.

With a Rawlsian objective, the constitutional problem then consist in maximizing the utility of the worst-off individual (namely 1) with respect to α. Formally, the solution α_R^n is defined as

$$\alpha_R^n = \arg\max_{\alpha}\{v_1^n(\alpha); \text{ s.t. } 0 \leq \alpha \leq 1\}$$

Differentiating v_1^n yields

$$\frac{dv_1^n}{d\alpha} = \frac{\partial V_1^n}{\partial \alpha} + \frac{\partial V_1^n}{\partial t}\frac{dt_2^*}{d\alpha} \tag{15}$$

Using (14) one easily shows that

$$\frac{\partial V_1^n}{\partial \alpha} = u'(b_1)(w_1 - \overline{w})t_2^*(\alpha) < 0.$$

This first term on the RHS of (15) term measures the direct impact on the utility of 1 of an increase in α. It is negative because an increase in α implies a *less* redistributive system which, not surprisingly, decreases the utility of the poorest individuals.

$c = b$. Then one has for $\alpha = 0$

$$t_i^*(0) = \frac{w_i}{w_i + \overline{w}}, \quad i = 1,2,3,$$

which increases with w_i. Note that in our setting, the "sufficient degree of concavity" is ensured by the assumption that relative risk aversion is larger than 1.

Observe in passing that if t were set directly (rather than determined through voting) only this term would be relevant so that a Beveridgean system ($\alpha = 0$) would necessarily be optimal. Now, when t is determined by voting, the indirect impact through the payroll tax (and the level of coverage) has to be accounted for; it is captured by the second term on the RHS of (15).

To interpret and sign this term, observe first that $\partial V_1^n(\alpha, t_2^*(\alpha))/\partial t < 0$; this follows from $t_1^*(\alpha) < t_2^*(\alpha)$ along with the concavity of the individual's objective function (7) in the voting problem (see section 3.1). As to $dt_2^*/d\alpha$, we know from (11) that it has the same sign as $(\overline{w} - w_2)$. Consequently, the following two cases have to be distinguished:

- $w_2 \leq \overline{w}$

In this case, both terms on the RHS of (15) are negative (for any α) so that the optimal solution is given by $\alpha_R^n = 0$. This result is not surprising. As mentioned above, the direct impact of an increase of α on the utility of type 1 is always negative. Setting a strictly positive Bismarckian factor can only be desirable if it brings the (voting equilibrium) tax rate closer to type 1's preferred rate. Now, when $w_2 < \overline{w}$ an increase in α has exactly the opposite effect. It brings about a further increase of an already "too high" tax rate (from type 1's perspective).

To sum up, a Beveridgean system is optimal. Furthermore, the *type* of social protection that emerges from our two stage process is exactly the same as when t is under direct control of the (Rawlsian) public authority.

- $w_2 > \overline{w}$

In this case, the two terms on the RHS of (15) are of opposite signs. In particular, one can easily check that $dv_1^n(0)/d\alpha$ now has an ambiguous sign. Consequently, it is no longer necessarily optimal to set α at zero; an interior solution is potentially possible though, of course, not guaranteed.[16]

Analytically, a precise characterization of the type of solution (interior or corner) is extremely difficult (and not very insightful), even for specific utility functions. The only straightforward result is that a corner solution will prevail when w_2 is sufficiently close to $\overline{w}$.[17] However, to make our main

[16] A corner solution at $\alpha = 1$, on the other hand can easily be ruled out.

[17] This follows from a simple continuity argument, using the fact that (15) is *strictly* negative when $w_2 = \overline{w}$.

point, namely that $\alpha_R^n > 0$ is effectively possible, it is sufficient to provide numerical examples, and this will be done in section 6 below.

Anticipating on this, observe that the possibility of an interior solution confirms one of the points made in the introduction. When $\alpha_R^n > 0$ the political process makes it desirable to adopt a social insurance system which is less redistributive than otherwise optimal. The level of α is then used as a device to induce a voting equilibrium tax rate (and level of coverage) which is more suitable to the poor.

3.3 Constitutional stage: utilitarian objective

Let us now reexamine the constitutional choice of α for a utilitarian (rather than Rawlsian) social welfare function. Using the notation introduced in the previous subsection, social welfare is now given by

$$SW_U^n(\alpha) = \sum_{i=1}^{3} v_i^n(\alpha) = \sum_{i=1}^{3} V_i^n(\alpha, t_2^*(\alpha)). \tag{16}$$

The constitutional problem consists in determining α_U^n that maximizes $SW_U^n(\alpha)$ subject to $0 \leq \alpha \leq 1$.

Differentiating (16) and rearranging yields:

$$\frac{dSW_U^n}{d\alpha} = \left(\frac{\partial V_1^n}{\partial \alpha} + \frac{\partial V_2^n}{\partial \alpha} + \frac{\partial V_3^n}{\partial \alpha}\right) + \left(\frac{\partial V_1^n}{\partial t} + \frac{\partial V_2^n}{\partial t} + \frac{\partial V_3^n}{\partial t}\right)\frac{dt_2^*}{d\alpha}. \tag{17}$$

The first term on the RHS measures the direct impact of a variation of α on welfare, while the second terms measures the indirect impact, through the induced variation in the voting equilibrium. Using expression (14), the definition of V_i^n, the first term can be expressed as follows:

$$\begin{aligned}\left(\frac{\partial V_1^n}{\partial \alpha} + \frac{\partial V_2^n}{\partial \alpha} + \frac{\partial V_3^n}{\partial \alpha}\right) &= t_2^*[(w_1 - \overline{w})u'(b_1) + (w_2 - \overline{w})u'(b_2) \\ &\quad +(w_3 - \overline{w})u'(b_3)] \\ &= t_2^* \operatorname{cov}(w, u'(b)),\end{aligned} \tag{18}$$

where cov denotes the covariance. Now, when $\alpha > 0$ one has $b_3 > b_2 > b_1$ so that (from the strict concavity of u) $\operatorname{cov}(w, u'(b)) < 0$. On the other hand, $\alpha = 0$ implies $b_3 = b_2 = b_1$ so that $\operatorname{cov}(w, u'(b)) = 0$. Not surprisingly, the direct impact of an increase in α (making the system less redistributive) on utilitarian welfare is thus negative. Consequently, if the tax rate were directly set by the utilitarian authority, the optimum would, one again, imply $\alpha = 0$. Like in the Rawlsian case, $\alpha > 0$ can only be desirable if it induces a more "adequate" tax rate in the second stage.

The fact that the first term on the RHS of (17) vanishes at $\alpha = 0$ has another interesting implication. It implies that the derivative at $\alpha = 0$ of social welfare reduces to:

$$\frac{dSW_U^n(0)}{d\alpha} = \left(\frac{\partial V_1^n}{\partial t} + \frac{\partial V_3^n}{\partial t} \right) \frac{dt_2^*}{d\alpha}, \tag{19}$$

where we have also used $\partial V_2^n(\alpha, t_2^*(\alpha))/\partial t \equiv 0$ (which follows directly from the definition of t_2^*). Keeping in mind that $dSW_U^n(0)/d\alpha > 0$ is a *sufficient* conditions for $\alpha_U^n > 0$, expressions (17), (18) and (19) allow us to characterize α_U^n in the following special cases (generated by varying w_2 for fixed levels of w_1 and w_3):

(i) $w_2 = \overline{w}$: from (11) one obtains $dt_2^*/d\alpha = 0$, which implies $dSW_U^n(0)/d\alpha = 0$ and, $dSW_U^n(\alpha)/d\alpha < 0$ for $\alpha > 0$. Consequently, one has $\alpha_U^n = 0$

(ii) $\overline{w} > w_2 \rightarrow w_1$. In this case, $t_2^* \rightarrow t_1^*$ and, at the limit, $\partial V_1^n(\alpha, t_2^*(\alpha))/\partial t = 0$. Further, one has $\partial V_3^n/\partial t > 0$ (from (12)) and $dt_2^*/d\alpha > 0$ (from (11)). Consequently, $dSW_U^n(0)/d\alpha > 0$ which implies $\alpha_U^n > 0$.

(iii) $\overline{w} < w_2 \rightarrow w_3$. Following the same reasoning as in (ii), we also get the same result that $\alpha_U^n > 0$.[18]

To sum up, with a utilitarian objective it may be optimal to set $\alpha > 0$ even if $w_2 < \overline{w}$. Contrast this with the result in the Rawlsian case (where $w_2 < \overline{w}$ necessarily implied $\alpha_R^n = 0$). Consequently, a positive α decreases the utility of the poorest type, but it nevertheless increases expected utility of the representative individual at the constitutional stage.

A more precise characterization of the conditions under which a positive α is appropriate does not appear to be possible with general utility functions.

[18]One now has $\partial V_1^n/\partial t < 0$ but also $dt_2^*/d\alpha < 0$, so that the sign of the derivative at zero remains the same as in case *(ii)*.

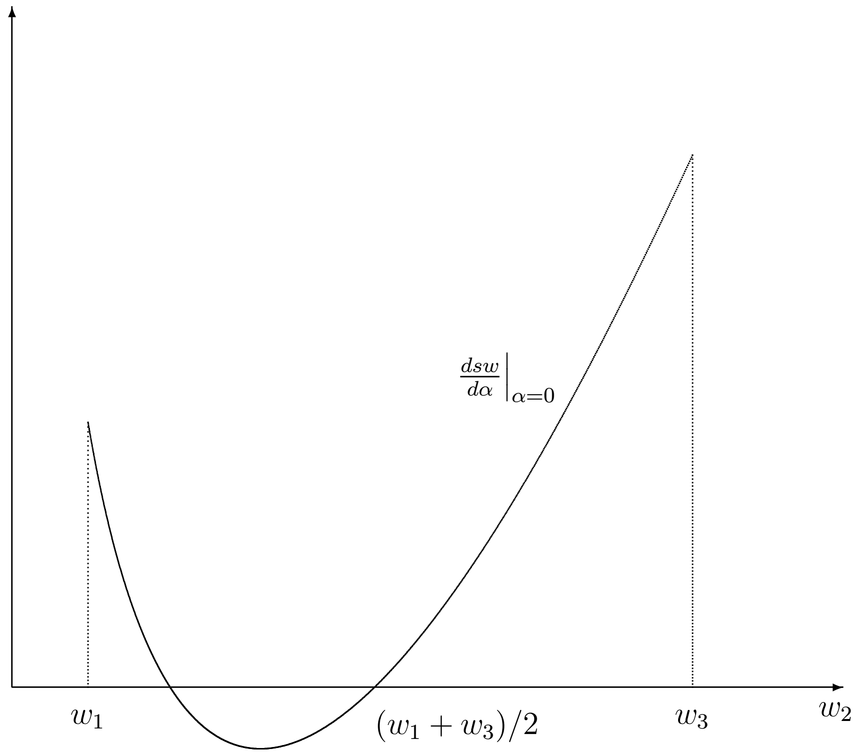

Figure 3: Derivative of social welfare at $\alpha = 0$

Once again, the numerical example in section 6 will provide some further insights. Anticipating on this, we can "complete" the analysis of $dSW_U^n(0)/d\alpha$ as w_2 varies (given w_1 and w_3) which is initiated through the discussion of cases (i)–(iii) above. Figure 3, represents the full curve, for the exponential specification considered in section 6. It appears that for this class of utility functions, $\alpha_U^n > 0$ is *always* optimal when $w_2 > \overline{w}$.

4 Private insurance authorized

We now reintroduce the possibility for individuals to buy additional private insurance if the level of public insurance chosen by the pivotal voter is too low for them. Recall that private insurance coverage must be positive ($\theta \geq 0$); individuals are not allowed to sell back part of their public insurance if they feel overinsured. Further, observe that supplementing social insurance by a private one is not the same as "opting out": buying private insurance has no impact on an individuals payroll tax bill. In other words, individuals cannot replace social insurance by private insurance.

4.1 Voting stage: the choice of t given α

As explained in section 2, individuals with incomes $w < \overline{w}$ prefer social insurance over private insurance regardless of the value of α. Consequently, type 1 individuals always prefer social insurance. When $w_2 < \overline{w}$, the same holds for type 2 individuals.

Consider now an individual with income $w > \overline{w}$. For $\overline{\alpha} = (\rho^p w - \overline{w})/(w - \overline{w})$, he is indifferent between social and private insurance; see (6). For $\alpha < \overline{\alpha}$, he prefers private insurance; in other words, his preferred payroll tax is $t^* = 0$. On the other hand, for $\alpha \geq \overline{\alpha}$, his preferred payroll tax is given by (7); put differently, once $\theta = 0$ individual preferences over payroll tax rates are the same as when private insurance is prohibited. Denote $\overline{\alpha}_i = \overline{\alpha}(w_i)$, $i = 2, 3$ for the type 2 and type 3 individuals respectively.

We are now in a position to determine the median voter and hence the tax rate chosen at the political equilibrium stage for the two cases.

- $w_2 < \overline{w}$

Individual 2 always prefers social insurance because he benefits from the redistribution ($\rho_2^s > 1$). For low values of α ($\alpha < \overline{\alpha}_3$), type 3 individual prefers private insurance and for $\alpha \geq \overline{\alpha}_3$, he has a preferred tax rate $t_3^*(\alpha)$; see Figure 4.[19]

For $\alpha < \overline{\alpha}_3$, type 1 individual is the median voter and the tax rate chosen by majority vote is $t_1^*(\alpha)$. For $\alpha \geq \overline{\alpha}_3$, the situation is the same as when private insurance is prohibited, and the median voter is of type 2.

To sum up, the voting equilibrium, denoted by $t^e(\alpha)$ is thus given by

$$t^e(\alpha) = \begin{cases} t_1^*(\alpha) & \text{if } 0 \leq \alpha < \overline{\alpha}_3 \\ t_2^*(\alpha) & \text{if } \overline{\alpha}_3 \leq \alpha \leq 1 \end{cases} \tag{20}$$

It is interesting to note that the availability of private insurance can favor individual 1 (even though he does not effectively buy such insurance).

[19] As a tie breaking rule, we assume that an individual who is indifferent between private and social insurance votes for his preferred social insurance protection (as defined by (7).

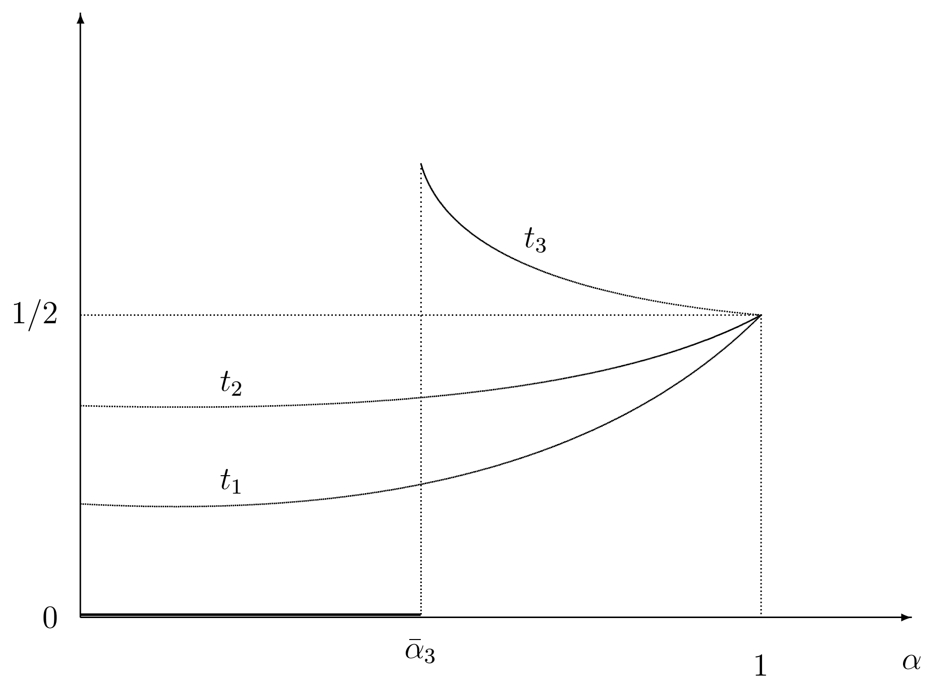

Figure 4: Preferred tax rates when private insurance is available and $w_2 < \overline{w}$

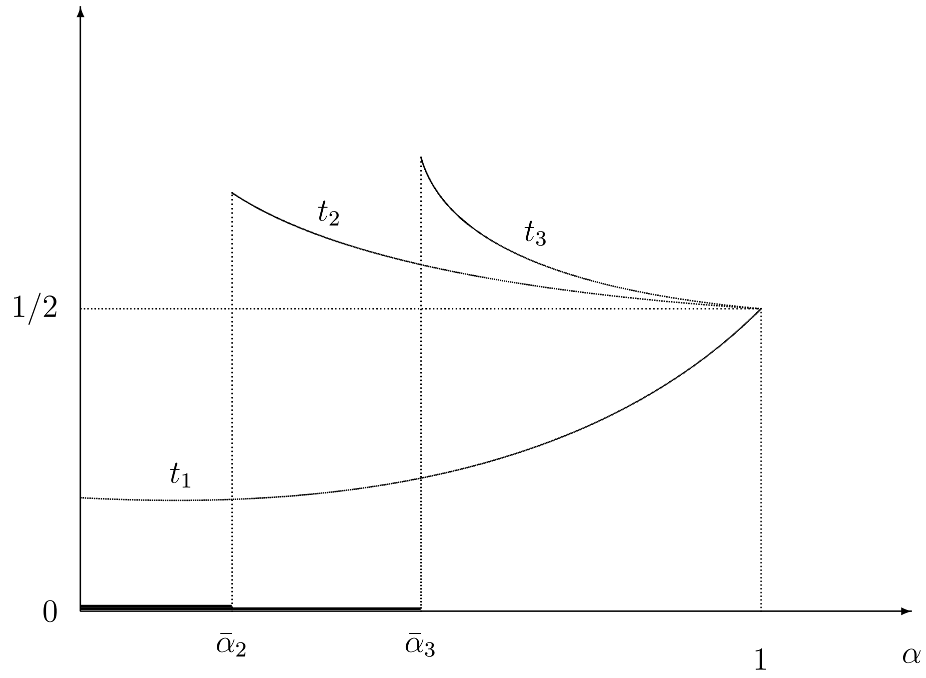

Figure 5: Preferred tax rates when private insurance is available and $w_2 > \overline{w}$

Specifically, for low values of α, type 1 individual becomes the median voter and can choose his preferred tax rate.

- $w_2 > \overline{w}$

The situation is now more complex; see Figure 5. For $\alpha < \overline{\alpha}_2$, types 2 and 3 individuals prefer private insurance. consequently, a majority of voters is in favor of a zero tax rate. For $\overline{\alpha}_2 \leq \alpha < \overline{\alpha}_3$, type 1 individual is the median voter and for $\alpha \geq \overline{\alpha}_3$, type 2 individual is the median voter.

In contrast with the previous case, too low values of α can lead to the abandonment of social insurance by a coalition 2/3. To sum up, the voting equilibrium is now given by:

$$t^e(\alpha) = \begin{cases} 0 & \text{if } 0 \leq \alpha < \overline{\alpha}_2 \\ t_1^*(\alpha) & \text{if } \overline{\alpha}_2 \leq \alpha < \overline{\alpha}_3 \\ t_2^*(\alpha) & \text{if } \overline{\alpha}_3 \leq \alpha \leq 1 \end{cases} \quad (21)$$

Before proceeding, it is interesting to point out that both (20) and (21) imply $t^e(\alpha) \le t_2^*(\alpha)$. In words, for any given level of α the tax rate with private insurance is less then or equal to the tax rate that obtains when only social insurance is available. Put differently, the availability of private insurance may decrease and will never increase the degree of generosity of social protection (as measured by the payroll tax rate). Consequently, it appears that the availability of private insurance may effectively undermine political support for a *given* social protection system.

4.2 Constitutional stage: Rawlsian objective

The analysis of the constitutional stage proceeds along the same lines as in sections 3.2 and 3.3. However, the type-specific utility levels achieved in the second stage have to be redefined to account for the availability of private insurance. Formally, we define

$$V_i^p(\alpha,t) = \max_{\theta\in[0,1]} u[w_i(1-t-\theta)]+u[t(\overline{w}+\alpha(w_i-\overline{w}))+\rho^p\theta w], \quad i=1,2,3, \quad (22)$$

and $v_i^p(\alpha) = V_i^p(\alpha, t^e(\alpha))$. Observe that $V_1^p(\alpha,t) \equiv V_1^n(\alpha,t)$ because individuals of type 1 never purchase private insurance. However, v_1^p and v_1^n may differ for the availability of private insurance may affect the voting equilibrium (identity of the median voter).

In the Rawlsian case, the constitutional problem then amounts to determine $0 \le \alpha_R^p \le 1$ which maximizes $v_1^p(\alpha)$. We have to distinguish two cases, but in each instance, the solution is rather straightforward.

- $w_2 < \overline{w}$.

Recall that in this case $t^e(0) = t_1^*(0)$: for $\alpha = 0$, the poorest individual is also the median voter in the second stage. Consequently, nothing can be gained from setting a positive level α and it immediately follows that $\alpha_R^p = 0$.[20]

- $w_2 > \overline{w}$

[20]Formally, $(0, t_1^*(0))$, maximizes $V_1^p(\alpha,t)$. Consequently, one has $v_1^p(0) = V_1^p(0, t_1^*(0)) > V_1^p(\alpha, t_1^*(\alpha)) = v_1^p(\alpha)$, for all $\alpha > 0$.

Only two candidate solutions need to be considered, namely $\alpha = 0$ and $\alpha = \overline{\alpha}_2$. An argument exactly similar to the one used in the previous case indeed shows that $\alpha > \overline{\alpha}_2$ is dominated by $\overline{\alpha}_2$. Similarly, one easily shows that $0 < \alpha < \overline{\alpha}_2$ is dominated by $\alpha = 0$.

To compare the utility levels implied by 0 and $\overline{\alpha}_2$, note that in both cases type 1 effectively chooses his preferred level of insurance: private for $\alpha = 0$ and social for $\alpha = \overline{\alpha}_2$. But then $\rho_1^s > 1 > \rho^p$ (obtained from (4)) immediately implies that the utility level is higher for $\overline{\alpha}_2$. In words, whatever α social insurance always has a higher rate of return for the low income type. If α is set "too low", the second stage voting will imply no social insurance; consequently, type 1 is left with private insurance. On the other hand, $\alpha = \overline{\alpha}_2$ ensures a positive level of social protection which, moreover, is precisely type 1's preferred level.

To sum up, when $w_2 > \overline{w}$, one has $\alpha_R^p = \overline{\alpha}_2 > 0$: it is always optimal to set a positive level of α at the constitutional stage.

4.3 Constitutional stage: utilitarian objective

Welfare is now given by

$$SW_U^p(\alpha) = \sum_{i=1}^{3} v_i^p(\alpha) = \sum_{i=1}^{3} V_i^p(\alpha, t^e(\alpha)), \tag{23}$$

and the solution is denoted by α_U^p. Observe that this expression differs in two respects from (16), its counterpart in the absence of private insurance. First, unlike V_i^n, V_i^p accounts for the individual's maximization with respect to private coverage; see (22). Second, with private insurance the median voter is not necessarily an individual of type 2.

Differentiating (23) with respect to α yields:[21]

$$\frac{dSW_U^p}{d\alpha} = \left(\frac{\partial V_1^p}{\partial \alpha} + \frac{\partial V_2^p}{\partial \alpha} + \frac{\partial V_3^p}{\partial \alpha}\right) + \left(\frac{\partial V_1^p}{\partial t} + \frac{\partial V_2^p}{\partial t} + \frac{\partial V_3^p}{\partial t}\right)\frac{dt^e}{d\alpha}. \tag{24}$$

The first term on the RHS of this expression can be rearranged exactly like in (18), provided that b_i's are properly redefined (to account for private

[21] One has to keep in mind though that $t^e(\alpha)$ may be discontinuous at $\overline{\alpha}_2$ and $\overline{\alpha}_3$; consequently, (24) does not apply for these values.

insurance). Observe that while the covariance term was zero at $\alpha = 0$ in the absence of private insurance, it is now negative for all $0 \leq \alpha \leq 1$.[22]

As in the previous case, $\alpha = 0$ would be optimal if t were set by the welfare-maximizing authority. To examine if the political process implies a different result (namely $\alpha_U^p > 0$), we have to distinguish the usual two cases.

- $w_2 < \overline{w}$.

A straightforward (but somewhat tedious) inspection of (24) (making use of (20)) makes it clear that no general result can be obtained for this case; both $\alpha_U^p = 0$ and $\alpha_U^p > 0$ are possible. However, compared to the setting without private insurance (section 3.3) the result $\alpha_U^p = 0$ appears to be much "more robust". Put differently, somewhat extreme assumptions appear to be needed to generate a positive Bismarckian factor.[23]

For instance, $\alpha_U^p > 0$ can be shown to be optimal if ρ^p is sufficiently low (sufficiently close to the level which yields $\theta_3 = 0$) while at the same time w_2 is sufficiently close to w_1.[24]

- $w_2 > \overline{w}$.

Now, $\alpha = 0$ implies $t^e = 0$. Put differently, a Beveridgean system induces a voting equilibrium which implies no social insurance at all.[25] Unlike in the Rawlsian case, it however not always the case that $\alpha = \overline{\alpha}_2$ dominates $\alpha = 0$. Nevertheless, it is easy to show the optimal α continues to be (strictly) positive. To establish this, we shall now show that $\alpha = 1$ necessarily yields a higher welfare than $\alpha = 0$.

First, observe that combining (21) and (10) yields $t^e(1) = 1/2$. Second, it is easily shown from (22) that $V_i^p(0,0) < V_i^p(1,1/2)$, $i = 1,2,3$.[26] Consequently, one has $v_i^p(1) > v_i^p(0)$, $i = 1,2,3$ which immediately implies that $\alpha = 1$ yields a higher level of welfare than $\alpha = 0$.

[22] It can be easily shown that $\theta_3 > \theta_2 \geq \theta_1$ (except if ρ^p is so low that $\theta_3 = 0$). Consequently, $b_3 > b_2 > b_1$ now holds even when $\alpha = 0$ (that is when social insurance benefits are the same for all).

[23] Recall that the first term on the RHS of (24) is negative at $\alpha = 0$. In addition, one has $\partial V_3^p/\partial t < 0$ (while $\partial V_3^n/\partial t > 0$).

[24] This is because when $\theta_3 \rightarrow 0$, one essentially returns to the setting without private insurance.

[25] Provided that $\overline{\alpha}_2 > 0$, which we assume for simplicity.

[26] The strict inequality rests on $\rho^p < 1$.

Intuitively, this result can be understood as follows. With a purely Bismarckian system, there is no redistribution, but tax rate corresponds to the preferred category of all types (perfect consumption smoothing). With a Beveridgean system, on the other hand, there will effectively be no redistribution either (for the tax rate is zero) and all individuals are then left with the (less efficient) private system.

Observe that while this property implies $\alpha_U^p > 0$ it does *not* imply that $\alpha_u^p = 1$. The optimum can well be at a lower level, and specifically at $\overline{\alpha}_2$; the numerical example in Section 6 provides illustrates this point.

To sum up, when $w_2 > \overline{w}$ both utilitarian and Rawlsian objectives imply that it is never optimal to adopt a Beveridgean system. In both case the adoption of a less redistributive system appears to be the "price to pay" to ensure the viability of social protection in the voting stage.

5 The welfare impact of private insurance

The previous sections have shown that the availability of private insurance has a significant impact on both the voting and the constitutional stages. In particular, it has been shown that private insurance tends to reduce the voting equilibrium tax rate and, hence, the generosity of a given social protection system. On the other hand, the availability of private insurance may increase the welfare of the poor (even though they to not effectively buy such insurance). Finally, it is clear that private insurance in itself tends to increase welfare by giving individuals an additional option. Consequently, if payroll taxes were set along with α at the constitutional stage, the availability of private insurance (even when "inefficient") would necessarily bring about a welfare-improvement. We shall now examine to what extent this remains true if the political process is accounted for.

Analytically, this is rather difficult, and precise results can only be derived for the Rawlsian objective:

- $\boldsymbol{w_2 < \overline{w}}$: with or without private insurance, the Rawlsian criterion implies that a Beveridgean system is chosen ($\alpha_R^n = \alpha_R^p = 0$). However, the utility of type 1 individuals is higher with private insurance because he is then the median voter; see sections 3.2 and 4.2. Consequently, in this case, it is never optimal to prohibit private insurance.

- $\boldsymbol{w_2 > \overline{w}}$: the result now depends on ρ^p, the rate of return of private insurance. When ρ^s is large (so that $\overline{\alpha}_2$ tends to 1), it is always optimal to prohibit private insurance. To see this recall that with private insurance, a positive level of public insurance arises only if $\alpha \geq \overline{\alpha}_2$. When $\overline{\alpha}_2 = 1$, one must then set $\alpha = 1$ (implying $t = 1/2$), but this outcome is also achievable (though of course not optimal) when private insurance is prohibited. When ρ^s is small ($\overline{\alpha}_2$ tending to 0), on the other hand, the availability of private insurance is necessarily welfare enhancing; the argument here is exactly similar to the one used above for the case $w_2 < \overline{w}$. To sum up, private insurance becomes socially undesirable when it is rather efficient. In that case it become more attractive for type 2 individuals and social insurance with a significant degree of redistribution cannot be sustained.

For the utilitarian objective, on the other hand, very few clearcut analytical results can be obtained. One of the results for the Rawlsian case, however, can easily be shown to remain valid: with $w_2 > \overline{w}$ and ρ^p sufficiently large, private insurance should be prohibited. For the rest, the comparisons appear to be ambiguous. The numerical illustration, to which we now turn, confirms that different patterns of results are effectively possible. In particular, when $w_2 > \overline{w}$, private insurance may increase or decrease welfare irrespective of the criterium which is used (Rawls or utilitarian).

6 Numerical examples

A numerical illustration is useful for several reasons. First, it illustrates the results obtained in the previous sections. Second, it provides some additional insight regarding the determination of α at the constitutional stage, specifically in those cases where the analytical results appear to be ambiguous. Third, it yields some answers to the question of whether or not (and when) supplementary private insurance ought to be allowed.

Our benchmark example is as follows:

- $u(x) = -e^{-\delta x}$ with $\delta = 1$;
- $\rho^p = 0.9$

	$w_2 < \overline{w}$		$w_2 > \overline{w}$	
	without	with priv. ins.	without	with priv. insur.
Rawls	$\alpha = 0$	$\alpha = 0$	$\alpha = 0.261$	$\alpha = \overline{\alpha}_2 = 0.475$
	$t = 0.434$	$t = 0.406$	$t = 0.532$	$t = 0.413$
	$v_1 = -0.082$	$v_1 = -0.081$	$v_1 = -0.102$	$v_1 = -0.085$
Utilitarism	$\alpha = 0.021$	$\alpha = 0$	$\alpha = 0.31$	$\alpha = \overline{\alpha}_2 = 0.475$
	$t = 0.435$	$t = 0.406$	$t = 0.530$	$t = 0.413$
	$sw = -0.054$	$sw = -0.048$	$sw = -0.036$	$sw = -0.030$

Table 1: Benchmark scenario

- two wage distributions: (w_1, w_2, w_3) is either $(5, 6, 15)$, implying that $w_2 < \overline{w} = 8.66$ or $(5, 14, 15)$ implying that $w_2 > \overline{w} = 11.33$.

The results are summarized in Table 1. It appears that when $w_2 < \overline{w}$ the α chosen at the constitutional stage is always zero (fully redistributive social insurance scheme) except for the utilitarian criterion when private insurance is prohibited (section 3.3). When $w_2 > \overline{w}$, on the other hand, the Bismarckian factor is always strictly positive and bigger with than without private insurance.

Furthermore, it is always optimal to allow private insurance. For the cases where $w_2 < \overline{w}$ this does not come as a surprise and merely confirms the analytical results of Section 5. For the remaining case, no analytical results were obtained and the examples show that private insurance may effectively be welfare improving in these settings.

To complete the picture, it is now interesting to provide an illustration of the opposite result, namely that the prohibition of private insurance may be appropriate. To achieve this, just change one parameter of the model, namely the degree of efficiency of private insurance ρ^p which is set to 0.95 instead of 0.9. Table 2 summarizes the results for the relevant case, namely $w_2 > \overline{w}$.

We now obtain the result that a more efficient private insurance system becomes socially undesirable. This comes from the fact that private insurance is now very attractive for type 2 individuals and some substantial redistribution is only possible when this private insurance is prohibited.

This example documents the importance of the political process in a

	$w_2 > \overline{w}$	
	without	with priv. insur.
Rawls	$\alpha = 0.261$	$\alpha = \overline{\alpha}_2 = 0.737$
	$t = 0.532$	$t = 0.453$
	$v_1 = -0.102$	$v_1 = -0.114$
Utilitarism	$\alpha = 0.31$	$\alpha = \overline{\alpha}_2 = 0.737$
	$t = 0.530$	$t = 0.453$
	$sw = -0.036$	$sw = -0.039$

Table 2: More efficient private insurance

particularly striking way. If the tax rate were set directly by the (welfare maximizing) public authorities, the availability of private insurance could only be welfare improving. Furthermore, a more efficient private system can only result in a more significant welfare improvement. When tax rates are determined through majority voting, on the other hand, both of these results *may* be reversed. Private insurance is no longer necessarily desirable—the fact that its availability undermines political support for social insurance may dominate its positive effects on welfare. Furthermore, a more efficient private system may now proof to be worse for it exacerbates the negative impact on political support.

7 Conclusion

In this paper, we have attempted to study the type of social insurance that would result from a two-stage constitutionalist approach. We define social insurance by two key characteristics: its redistributiveness and its generosity. The generosity represents the amount of resources that society is prepared to devote to social insurance; it is measured by the payroll tax rate. A tax increase has two effects: benefits increase but at the same time disposable income decreases. The redistributiveness represents the extent of redistribution that social insurance can implement for a given amount of resources; it is inversely related to the Bismarckian factor.

In our two-stage procedure, the Bismarckian factor is chosen at the con-

	$w_2 < \overline{w}$		$w_2 > \overline{w}$	
	without	with priv. insur.	without	with priv. insur.
Rawls	$\alpha = 0$	$\alpha = 0$	$\alpha \geq 0$	$\alpha = \overline{\alpha}_2$
Utilitarism	$\alpha \geq 0$	$\alpha \geq 0$	$\alpha > 0$	$\alpha \geq \overline{\alpha}_2$

Table 3: The optimal level α in the different cases

stitutional level on the basis of either a Rawlsian or a utilitarian social welfare function. The tax rate is then chosen at the second stage by majority voting.

The main results are summarized in Table 3 and they depend on several factors: the distribution of wage, the concavity of the individual utility function, the social objective but also whether or not social insurance can be supplemented by private insurance. In words, the main conclusions that have emerged are the following. First, it may be appropriate to adopt a system which is less redistributive than otherwise optimal, in order to ensure political support for an adequate level of coverage in the second stage. Second, as expected, private insurance does undermine the political support for social insurance. Third, supplementary private insurance may nevertheless increase the welfare of the poor, even if it is effectively bought only by the rich. Fourth, and last, the case for prohibiting (supplementary) private insurance may become stronger when the efficiency of private insurance markets increases.

From an economic policy perspective, the main lesson that emerges is that the political process may have a significant impact on the design of redistributive policies. It may make it desirable to adopt less redistributive social protection or to prohibit otherwise efficient supplementary private insurance systems.

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