Social security and variable retirement schemes. An optimal income taxation approach.

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Abstract

In a number of countries workers retire early, probably too early and this is mainly due to implicit taxation on continued activity of elderly workers. In a world of laissez-faire or of first-best efficiency, there would not be such implicit taxation. The point of this paper is that if there is a redistributive objective and lump-sum instruments are not available distortions are unavoidable and early retirement cannot be averted. We consider a reduced form model wherin individuals differ in their productivity and their capacity to work long and have to choose both their weekly labor supply and their age of retirement. In such a setting the government designs an optimal non linear tax-transfer that maximizes a utilitarian welfare function observing weekly earnings and the length of active life but not individuals'productivity and health status.

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1 Introduction

Early retirement is currently being observed in most but not all European countries. The average labor participation in the age group 55-64 ranges from

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24 per cent in Belgium, to 88 per cent in Iceland, with the bulk of countries closer to Belgium than to Iceland. Early retirement per se is a blessing for society rather than a problem, provided that it does not represent a drain. However, as generational accounts show, even though the bulk of the bill for the current generation of retirees is being financed by the retirees themselves within an incentive structure that makes it attractive, the fact is that it is future generations who are paying for the balance.

One can speak of an optimal retirement age that varies across individual features such as wealth, productivity and health, but which also depends on the setting: laissez-faire, first-best and second-best optimum. In both the laissez-faire and the first-best optimum setting, people retire when the marginal utility of inactivity is equal to their marginal productivity at work. People in poor health and with low productivity will retire earlier than people in good health and with high productivity.

As it has been shown by a number of authors, notably Gruber and Wise [1999] and Blondal and Scarpetta [1998] the observed age of retirement is likely to be lower than the optimal one in a number of countries. The bulk of explanation seems to rest on the incentive structure implied by social protection programs aimed at elderly workers: pension plans but also unemployment insurance, disability insurance and early retirement schemes. As they show, prolonged activity for elderly workers is subject to an implicit tax which includes both the payroll marginal tax and forgone benefits. In other words the social protection system is far from being actuarially fair at the margin in countries such as Belgium, France, Germany or the Netherlands where people retire relatively early. On the other hand, in Japan, Sweden and the US the implicit tax is much lower, the system tends to be rather neutral and people retire much later.

For obvious reasons early retirement puts pressure on the financing of health care and pension schemes. This problem is made worse by growing longevity. In the European Union life expectancy at age 65 has increased by more than one year per decade since 1950. As a consequence, instead of 45-50 years of work and 5-10 years of retirement of half a century ago, a young worker can now expect to work for 30-35 years and retire for 15-20 years.

Since increased longevity is accompanied by better health, the obvious solution would seem to be to reverse the trend towards early retirement by reducing the subsidies inducing it, and increasing the statutory retirement age. Yet, as it turns out, it is difficult to conduct such a reform. The political power of individuals close to retirement, and of those already retired make it is so.

Furthermore, as we show in this paper the implicit tax on postponed retirement is not necessarly due to bad design but can be due to the desire by public authorities of using social security for redistribution when non distortionary tools are not available.

When designing a redistributive social security system, it is important to take into account the wide variability in the capacity to work – a variability that is likely to widen as life expectancy increases. The practical issue is how to care for elderly workers who are in poor health without, on the other hand, opening the door of retirement to those who would like to stop working but are quite capable of continuing. In fact, a reform of social security ought to include a close connection between pensions systems and the system of insurance for the sick, as well as the determination of a more flexible retirement age together with actuarial adjustment of yearly benefits. The ideal outcome would then be to have early retirees because of poor health receive relatively generous benefits while early retirees unwilling to continue working would receive actuarially low pensions.

The purpose of this paper is to derive what policy towards social security benefits, payroll taxation and retirement age a utilitarian social planner ought to conduct with heterogeneous individuals differing in two unobservable characteristics: their level of productivity and their health status. We show that in a setting of imperfect information, a distortion towards early retirement is always desirable. To induce highly productive and healthy workers to retire efficiently, namely when their labor disutility is marginally equal to their productivity, it is desirable to induce less productive and less healthy workers to retire earlier. We also show that the retirement distortion is more important when the source of heterogeneity is health than when it is productivity.

We use the so-called optimal income tax approach to design a non linear tax-transfer function depending upon two variables: the weekly income and the retirement age[1]. There exists a theoretical literature dealing with various aspects of the issue of social security, disability insurance and retirement. It focuses on disability-contingent retirement rules [Diamond-Mirrlees, 1986], long-term labor contracts encompassing retirement rules [Lazear, 1979] and the implicit inducement to retirement of existing public but also private pension plans [Crawford-Lilien, 1981, Fabel, 1994]. This literature is positive;

[1] See Maderner-Rochet (1995) who also deal with this problem in another setting.

it tries to explain retirement behavior and to explain the observed evolutions in retirement practice.

The rest of the paper is organized as follows. Section 2 presents the basic model. Section 3 yields the market and the first best solutions. In section 4, differences in health and productivity are studied in a second best setting. To keep the presentation simple and without loss of generality, we mainly focus on an economy with two types of individuals. Section 5 provides a number of numerical examples.

2 The basic model

Consider the case where an individual has preference over consumption c and weekly labor ℓ which can be expressed by an instantaneous utility function $V(t)$ assumed to be additively separable:

$$U(t) = u(c(t)) - r(t)V(\ell(t))$$

where u and V fulfill the usual assumptions and $r(t)$ denotes the instantaneous increasing intensity of labor disutility. Let date 0 denote entrance to the labor force, h; the maximum life-span and z; the retirement age. Assuming the interest rate and the discount factor both equal to 0, lifetime utility can be written as:

$$U = \int_0^h u(c(t))\,dt - \int_0^z r(t)V(\ell(t))\,dt.$$

Assuming a constant weekly productivity w over time, the lifetime budget constraint is:

$$\int_0^h c(t)dt = \int_0^z [wl(t) - \tau(wl(t))]\,dt + \int_z^h p'(t)dt$$

where $\tau(wl(t))$ is an instantaneous non linear tax depending on weekly income and $p'(t)$ the instantaneous level of pension, the total pension being given by $p(z)$. To make things simple, we impose that $l(t) = l$ is a time invariant choice[2]. Separability, concavity of the instantaneous utility functions,

[2] Otherwise, $l(t)$ would be a decreasing sequence over time.

perfect capital markets and certain lifetimes imply that each individual will set his level of consumption equal in all periods. Denoting $y = wl$, one can rewrite the budget constraint as follows:

$$hc = zwl - T(y;z)$$

where $T(y;z) = z\tau(wl) + p(h) - p(z)$ represents the social security tax transfer scheme. The implicit tax on retirement that have estimated Gruber and Wise [1999] is nothing else that $\frac{\delta T(y;z)}{\delta z} = \tau(wl) - p'(z)$. In other terms, an additional year of work may imply a double cost: the payroll tax $\tau(wl)$ and foregone benefits if $p'(z) < 0$. In the rest of the paper, we use this reduced tax function $T(y;z)$. The lifetime utility is:

$$U = hu(c) - V(\ell)R(z)$$

where

$$R(z) = \int_0^z r(t)dt.$$

The function $R(z)$ with $R'(z) = r(z) > 0$ and $R''(z) > 0$ by assumption denotes the disutility for a working life of length z. Labor disutility, regarding the length of working life z, can be interpreted in terms of an indicator of health. Healthy individuals accordingly would have a lower $R(z)$ than individuals whose poor health makes it impossible to work too long. There is another labor disutility which concerns the length of work week, $V(l)$. We assume that this function $V(l)$ is the same for all. In other words, there is no heterogeneity in this respect. This choice is obvious: this paper deals with retirement age; z can be seen as the length of the work career but also as the retirement age.

Each individual is characterized by two parameters: his productivity level w_i and his disutility for the retirement age $R_j(z) = R(z;\alpha_j)$ with $\frac{\delta R}{\delta \alpha_j} > 0$. A highly productive (resp less productive) individual has productivity w_h (resp w_l) with $w_h > w_l$ while a healthy (resp disable) individual is characterised by a parameter α_l (resp α_h) with $\alpha_h > \alpha_l$ so that $R_h(z) > R_l(z)$ for every z. We denote a type of individual with subscripts $(i;j)$; i denoting the productivity index and j the age of retirement disutility index.

3 The laissez-faire economy and the first best

3.1 The laissez faire

In a laissez-faire economy, deleting the subscripts refering to individuals types, every agents solve the following problem:

$$\underset{l;z}{Max}\ h\,u\left(\frac{w\ell z}{h}\right) - V(\ell)R(z)$$

The first order conditions with respect to l and z are respectively:

$$\begin{aligned} u'(c)\,wz - V'(\ell)\,R(z) &= 0 && (1)\\ u'(c)\,w\ell - V(\ell)\,R'(z) &= 0. && (2) \end{aligned}$$

With (1) and (2) one obtains the usual equality between marginal rates of substitution between work and consumption and their related marginal productivity.

$$\begin{aligned} MRS_{cl} &= \frac{V'(l)R(z)}{u'(c)} = wz && (3)\\ MRS_{cz} &= \frac{V(l)R'(z)}{u'(c)} = wl && (4) \end{aligned}$$

where MRS_{ab} stands for the marginal rate of substitution between a and b.

Combining (1) and (2), the relative choice of l and z is given by:

$$MRS_{lz} = \frac{V(l)R'(z)}{V'(l)R(z)} = \frac{l}{z} \qquad (5)$$

This condition is also the result of the aggregate effort minimization implicit in the dual program:

$\underset{l;z}{Min}\ E = V(l)R(z)$

s to: $I = wlz$

where I is aggregate earnings and E denotes aggregate effort. We can easily represent this problem in the (z,l) space on figure 1:

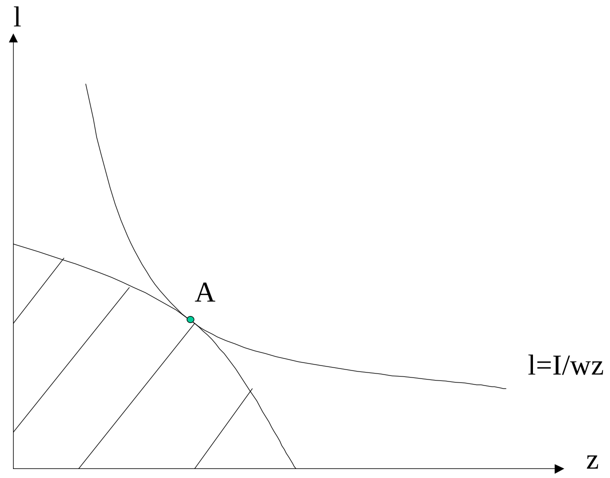

Figure 1: The effort minimization problem

The shaded area represents the $(l; z)$ combinations that generates a level of effort lower than or equal to a fixed level say $\overline{E}$. The optimal (non distorted) $(l; z)$ choice is given by the point A where $\frac{R'(z)/R(z)}{V'(l)/V(l)} = \frac{l}{z}$, that is, where the marginal rate of substitution between l and z is equal to the slope of the aggregate earnings curve. Note that rearranging the terms, one obtains:

$$\varepsilon_V(l) \equiv \frac{lV'(l)}{V(l)} = \varepsilon_R(z) \equiv \frac{zR'(z)}{R(z)} \tag{6}$$

which corresponds to an equality between the elasticities of disutility for the work week $\varepsilon_V(l)$ and that for the retirement age $\varepsilon_R(z)$. To make things short, we will call the first, the work week elasticity and the second the retirement elasticity.

In order to better understand the differences between the choices of the two types of individuals, we assume the two following monotonicity properties:

- Assumption 1: For every z, $\varepsilon_{R_l}(z) \leq \varepsilon_{R_h}(z)$

• Assumption 2: $\varepsilon_V(z)$ and $\varepsilon_{R_j}(z)$ $(j = h; l)$ are respectively non decreasing functions of l and z.

The first assumption says that, for the same age of retirement, a more disabled individual has a greater or equal retirement elasticity. The second assumption is a normality assumption that implies a non decreasing elasticity for both types of labour.[3]

The two following figures compare the two optimal choices of l and z for the same aggregate earnings I with two individuals differing respectively in their productivity and their preferences for retirement.

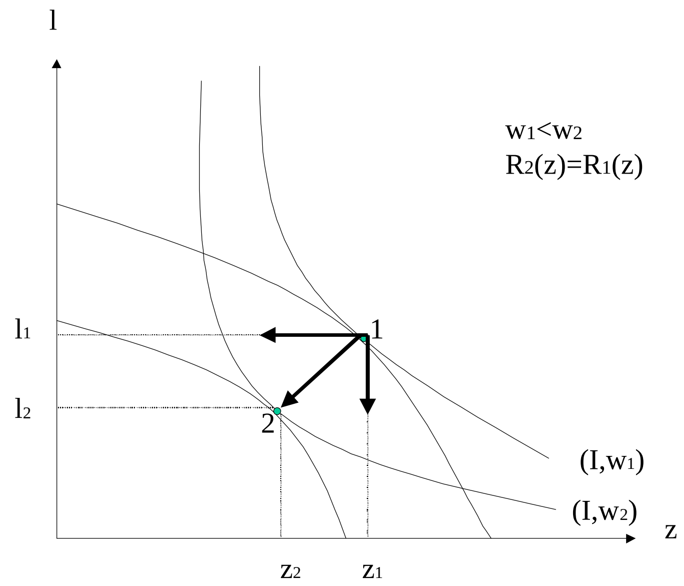

Figure 2: Choices of $(l; z)$ for the two productivity types

In figure 2, the more able individual (individual 2) chooses both a lower z and a lower l. This is the case if $\varepsilon_R(z)$ and $\varepsilon_V(z)$ are strictly increasing functions of z and l (this ensures that l and z are complements). For the

[3] A necessary and sufficient condition for this is that:

(i) $1 + \frac{lV'(l)}{V(l)} - \frac{lV''(l)}{V(l)} > 0$ for every l;

(ii) $1 + \frac{zR'(z)}{R(z)} - \frac{zR''(z)}{R(z)} > 0$ for every z.

extreme cases where R or V are isoelastic functions, the choice of either l (horizontal arrow) or z (vertical arrow) are the same for the two individuals (see equation (6)). To sum up, for the same aggregate earnings, the $(l; z)$ choice of an individual with a given ability will always lie south west of the point chosen by a less able individual if $"_R(z)$ and $"_V(z)$ are non decreasing functions (assumption 2).

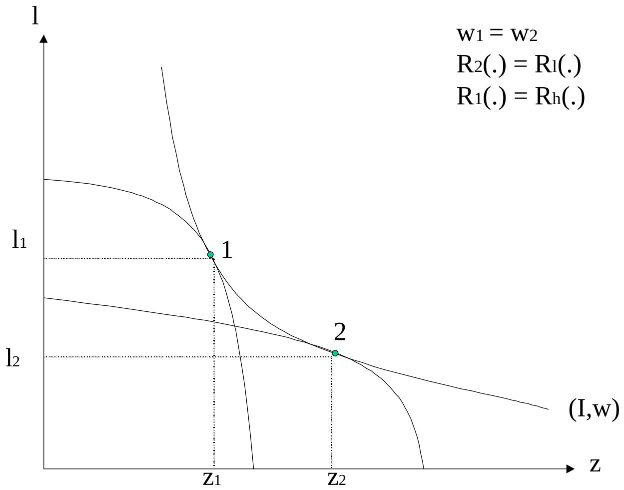

Figure 3: Choices of $(l; z)$ for the 2 health types

Figure 3 shows that the individual who has a greater disutility for the retirement age (individual 2) will choose a higher l and a lower z than the other individual if the marginal rate of substitution between l and z is higher for this individual, that is, if $"_{R_h}(z) > "_{R_l}(z)$. In the extreme example where $"_{R_h}(z) = "_{R_l}(z)$, the two iso-e¤ort curves will be parallel in the $z; l$ space so that for the same aggregate earnings, they will choose the same pair $z; l$.

3.2 The social optimum

The above market solution can be contrasted with what we call the …rst best social optimum obtained by a social planner who observes both w_i and R_j and maximizes an additive social welfare function: $\sum_{i;j} f_{ij} ©[U_{ij}]$; where f_{ij} is the proportion of type ij's individuals, © is a concave function that re‡ects the preference for equity of the social planner and U_{ij} is the lifetime utility of ij individuals. So doing, it takes into account the resource constraint that aggregate consumption cannot exceed aggregate production. The Lagrangean of this problem is thus:

$$\underset{c_{ij};\ell_{ij};z_{ij}}{Max} \sum_{i;j} f_{ij}\Psi[h\,u(c_{ij}) - V(\ell_{ij})R_j(z_{ij})] - \gamma \sum_{i} f_{ij}(hc_{ij} - w_i\ell_{ij}z_{ij}):$$

where γ is the Lagrange multiplier associated to the ressource constraint. The first order conditions for every $i;j$ are:

$$u'(c_{ij})\Psi'[U_{ij}] - \gamma = 0 \quad (7)$$

$$V'(\ell_{ij})R_j(z_{ij})\Psi'[U_{ij}] - \gamma w_i z_{ij} = 0 \quad (8)$$

$$V'(\ell_{ij})R_j'(z_{ij})\Psi'[U_{ij}] - \gamma w_i \ell_{ij} = 0 \quad (9)$$

We have for every $i;j$ the non distorted choices of equations (3), (4) and (5) and the equality of the marginal social valuations of consumption.

In this simple version, the time dimension is implicit. We assume that there is a zero discount rate and a zero rate of interest. In the LF, there is some saving during the working period: $(w_i\ell_{ij} - c_{ij})z_{ij}$ which is used to finance consumption at retirement: $(h - z_{ij})c_{ij}$: Therefore, a social security scheme with a non distortionary contribution: $\left(w_i\ell^*_{ij} - c^*_{ij}\right)z^*_{ij}$ and social security benefits equal to $\left(h - z^*_{ij}\right)c^*_{ij}$ could decentralize the FB. The number of hours ℓ_{ij} and the age of retirement z_{ij} would be chosen optimally as (1) and (2) coincide with the optimality conditions.

Such a decentralization policy raises a lot of informational problems. In the reality, one does not observe individuals' characteristics w_i and R_j. Yet, weekly gross earnings $\ell_{ij}w_i$ and the retirement age z_{ij} are common knowledge. In the next section, we consider this situation of asymmetric information where the government has limited information and some individuals have the opportunity of mimicking others that are better treated from their own viewpoint.

4 Second best taxation

4.1 Implementation

In order to achieve a second best redistribution, the government will use a non linear income tax schedule $T(y;z)$ depending upon the gross weekly income and the age of retirement. Under this tax schedule, the individual's problem becomes:

$$\underset{l_{ij};z_{ij}}{Max}\ u(c_{ij}) - V\left(\frac{y_{ij}}{w_i}\right)R_j(z_{ij})$$

$$s.to:\ c_{ij} = y_{ij}z_{ij} - T_{ij}(y_{ij};z_{ij})$$

From the first order conditions, one obtains:

$$MRS_{cl}^{ij} = w_i z_{ij}\left(1 - \frac{1}{z_{ij}}\frac{dT_{ij}(y_{ij};z_{ij})}{dy_{ij}}\right) \tag{10}$$

$$MRS_{cz}^{ij} = y_{ij}\left(1 - \frac{1}{y_{ij}}\frac{dT_{ij}(y_{ij};z_{ij})}{dz_{ij}}\right) \tag{11}$$

and the implicit relation between l and z being:

$$MRS_{lz}^{ij} = \frac{l_{ij}}{z_{ij}}\left[\frac{1 - \frac{1}{y_{ij}}\frac{dT_{ij}(y_{ij};z_{ij})}{dz_{ij}}}{1 - \frac{1}{z_{ij}}\frac{dT_{ij}(y_{ij};z_{ij})}{dy_{ij}}}\right]$$

The $(c;l)$ and $(c;z)$ choices are distorted downward (resp upward) if the marginal taxes on weekly income and on the age of retirement are positive (resp negative). The $(l;z)$ choice is distorted upward (resp downward) if the marginal tax on the retirement age expressed in weekly income units $\frac{1}{y_{ij}}T_{ij}^{0}(z_{ij})$ is greater (resp lower) than the maarginal tax on the weekly income expressed in age of retirement unit $\frac{1}{z_{ij}}T_{ij}^{0}(y_{ij})$.

We will then say that the $(l;z)$ choice is distorted upward if individuals who retire earlier pay less taxes, their gross aggregate income GI_{ij} being kept constant, that is, if:

$$\left(\frac{dT_{ij}(y_{ij};z_{ij})}{dz_{ij}}\right)_{GI_{ij}=w_i l_{ij} z_{ij}} = \frac{dT_{ij}(y_{ij};z_{ij})}{dz_{ij}} - \frac{y_{ij}}{z_{ij}}\frac{dT_{ij}(y_{ij};z_{ij})}{dy_{ij}} > 0$$

In the same way, there will be a downward distortion of the $(l;z)$ choice if:

$$\left(\frac{dT_{ij}(y_{ij};z_{ij})}{dy_{ij}}\right)_{G l_{ij}=w_i l_{ij} z_{ij}} = \frac{dT_{ij}(y_{ij};z_{ij})}{dy_{ij}} - \frac{z_{ij}}{y_{ij}}\frac{dT_{ij}(y_{ij};z_{ij})}{dz_{ij}} > 0$$

Note that these two conditions are mutually exclusive. The case where $\left(\frac{dT_{ij}(y_{ij};z_{ij})}{dz_{ij}}\right)_{G l_{ij}=w_i l_{ij} z_{ij}} = 0$ corresponds to a case where $T_{ij}(y_{ij};z_{ij}) = T_{ij}(y_{ij}z_{ij})$: Then the tax depends only upon gross life cycle income.

4.2 The second best optimum

To present the second best optimum, we only consider a setting with two types. What will matter is the correlation between the two characteristics and the relative heterogeneity in these two characteristics.We assume that the correlation between the two types is non positive[4]. Figure 4 illustrates three possible cases with the arrow representing the direction of mimicking:

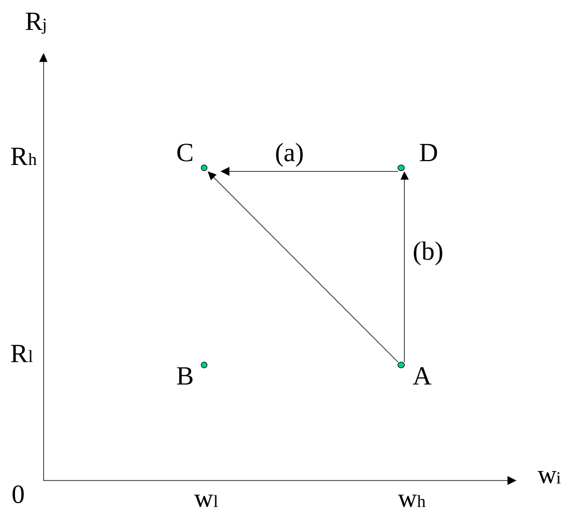

Figure 4: The con…guration of types

[4] We exclude the strict positive correlation case for which little can be said except when one di¤erence overwhelmingly dominates the other.

We will first present the general case where we don't restrict the correlation between the types to a certain value (represented by the diagonal arrow in the graphic) and then present results in the two subcases where the correlation is 0. Subcase (a) will refer to the case where both individuals have the same preference over the age of retirement but differ in their productivity. Subcase (b) will refer to the case where both agents differ in their preference for the age of retirement but have the same productivity. Formally, the economy is composed of two agents 2 and 1 being characterized respectively by a pair $(w_2 = w_h, R_2(z) = R_l(z))$ and $(w_1 = w_l, R_1(z) = R_h(z))$. In case (a), the two agents will have, $R_1(z) = R_2(z) = R_h(z)$ and in case (b) $w_1 = w_2 = w_h$.

The objective of the government is now to maximize social welfare subject to the incentive compatibility constraint that agent 2 does not mimick agent 1. It has also to meet the revenue constraint. The problem can be expressed by the following Lagrangean:

$$\max_{c_i,y_i,z_i} \sum_i f_i\Phi[U_i] + \mu\left(\sum_i f_i\,(y_i z_i - hc_i)\right) + \lambda\left(hu(c_2) - V\left(\frac{y_2}{w_2}\right)R_2(z_2) - hu(c_1) + V\left(\frac{y_1}{w_2}\right)R_2(z_1)\right)$$

where μ and λ stand respectively for the Lagrangean multipliers associated with the revenue and the incentive compatibility constraints. First order conditions with respect to c_i, y_i and z_i are:

$$f_1u'(c_1)\Phi'[U_1] - \mu f_1 - \lambda u'(c_1) = 0 \quad (12)$$

$$f_2u'(c_2)\Phi'[U_2] - \mu f_2 + \lambda u'(c_2) = 0 \quad (13)$$

$$-\frac{f_1}{w_1}V'(l_1)R_1(z_1)\Phi'[U_1] + \mu f_1 z_1 + \frac{\lambda}{w_2}V'(\bar{l}_2)R_2(z_1) = 0 \quad (14)$$

$$-\frac{f_2}{w_2}V'(l_2)R_2(z_2)\Phi'[U_2] + \mu f_2 z_2 - \frac{\lambda}{w_2}V'(l_2)R_2(z_2) = 0 \quad (15)$$

$$-f_1V(l_1)R_1'(z_1)\Phi'[U_1] + \mu f_1 y_1 + \lambda V(\bar{l}_2)R_2'(z_1) = 0 \quad (16)$$

$$-f_2V(l_2)R_2'(z_2)\Phi'[U_2] + \mu f_2 y_2 - \lambda V(l_2)R_2'(z_2) = 0 \quad (17)$$

where the upper bar denotes the choice of the mimicker.

As usual in optimal tax problems, there is no distortion for the mimicker, that is, individual 2. We now analyse individual 1's choices of (c_1, l_1); (c_1, z_1) and (l_1, z_1). Equation (13) and (15) give:

$$MRS^1_{cl} = \frac{1}{1 + \frac{\lambda u'(c_1)V'(l_1)R_1(z_1)}{f_1 \mu}\left(1 - \frac{w_1}{w_2}\frac{\overline{MRS}^2_{cl}}{MRS^1_{cl}}\right)} w_1 z_1; \qquad (18)$$

where $\overline{MRS}^2$ denotes individual 2's marginal rate of substitution when mimicking individual 1. We have $MRS^1_{cl} > \overline{MRS}^2_{cl}$ because $\overline{l_2} < l_1$ and $R_2(z_1) < R_1(z_1)$:

One sees immediatly that $MRS^1_{cl} < w_1 z_1$ so that there is a marginal downward distortion in the work week. That is, for a given age of retirement, the individual is induced to choose a lower l with repect to c than he would do in a first best economy. In other words, by equation (11), the marginal tax on weekly income is positive.

Now combining equation (13) and (16) one obtains:

$$MRS^1_{cz} = \frac{1}{1 + \frac{\lambda u'(c_1)V(l_1)R'_1(z_1)}{f_1 \mu}\left(1 - \frac{\overline{MRS}^2_{cz}}{MRS^1_{cz}}\right)} y_1 \qquad (19)$$

where $MRS^1_{cz} > \overline{MRS}^2_{cz}$:

One has that $MRS^1_{cz} < y_1$: there is a marginal downward distortion on z_1. That is, for a given weekly labour supply, the individual is induced to choose a lower z relative to c than he would do in a first best setting. By equation (12), the marginal tax on the retirement age is positive.

Combining equations (19) and (20), we find:

$$MRS^1_{lz} = \left[\frac{1 + \frac{\lambda u'(c_1)V(l_1)R'_1(z_1)}{f_1 \mu}\left(1 - \frac{\overline{MRS}^2_{cz}}{MRS^1_{cz}}\right)}{1 + \frac{\lambda u'(c_1)V'(l_1)R_1(z_1)}{f_1 \mu}\left(1 - \frac{w_1}{w_2}\frac{\overline{MRS}^2_{cl}}{MRS^1_{cl}}\right)}\right] \frac{l_1}{z_1} \qquad (20)$$

Then

$$MRS^1_{lz} = \frac{R'(z_1)/R(z_1)}{V'(l_1)/V(l_1)} \gtreqless \frac{l_1}{z_1} \quad , \quad \frac{\varepsilon_V(\overline{l_2})}{\varepsilon_V(l_1)} \gtreqless \frac{\varepsilon_{R_1}(z_1)}{\varepsilon_{R_2}(z_1)}$$

Wether the $(l; z)$ is distorted downward or upward depends upon the relative differences in characteristics. If the difference between week labour elasticities of the mimicker and individual 1 is larger than the one between retirement elasticities, the $(l;z)$ choice is downward distorted. Otherwise, it is upward distorted. In order to better understand the idea, two extreme cases are now described:

4.2.1 Subcase (a): $R_1(z) = R_2(z)$

$$\frac{R'(z_1)/R(z_1)}{V'(l_1)/V(l_1)} \gtreqless \frac{z_1}{l_1} \Leftrightarrow \varepsilon_V(\bar{l}_2) \lesseqgtr \varepsilon_V(l_1)$$

One sees immediately that if V is isoelastic, the $(l_1;z_1)$ choice is not distorted. As discussed earlier, if V is isoelastic, z is fixed and equal for both individuals. The weekly income is then distorted downward and the age of retirement is the same as in the first best.

In general, when ε_V is increasing, the marginal rate of substitution between l and z is greater in absolute value than the slope of the gross income curve. That is, for the same I, individual 1 has, at the second best (point B on figure 5) a greater z and a lower l relative to the first best choice (point A).

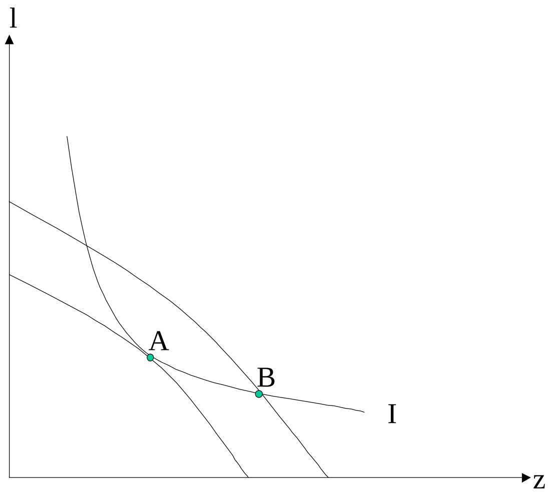

Figure 5: The second best choice of $(l;z)$ when w_i and l_i are not observable

This result is an interesting extension of the optimal income taxation litterature. Indeed, when the elasticity of V is increasing, the government knows that individual 2 prefers to have a relatively greater weekly income than individual 1 for a given gross life cycle income (the slope of the iso effort curve is lower for individual 2 in the (z, y) space). The optimal allocation in case of asymetric information then leads to a relatively higher retirement age and a lower weekly labour supply for individual 1.

4.2.2 Subcase (b): $w_1 = w_2$

$$MRS(l_1, z_1) = \frac{R'(z_1)/R(z_1)}{V'(l_1)/V(l_1)} \gtrless \frac{z_1}{l_1} \quad , \quad \varepsilon_{R_1}(z_1) \lessgtr \varepsilon_{R_2}(z_1) \tag{21}$$

If R_1 and R_2 have the same elasticity, there is no distortion for the (l_1, z_1) choice. A typical example of this is when $R_1(\cdot) = \delta R_2(\cdot)$ with $\delta > 1$. As shown previously, the (l, z) choices are the same for the 2 individuals for a given gross life cycle income.

In general, $\varepsilon_{R_1}(z_1) > \varepsilon_{R_2}(z_1)$ so that the slope of the effort frontier is lower than the slope of the gross income line. In other words, for I given, at the second best (point B in figure 6), the individual will choose a greater l and a lower z relative to the first best choice (point A). In this special case, early retirement is encouraged.

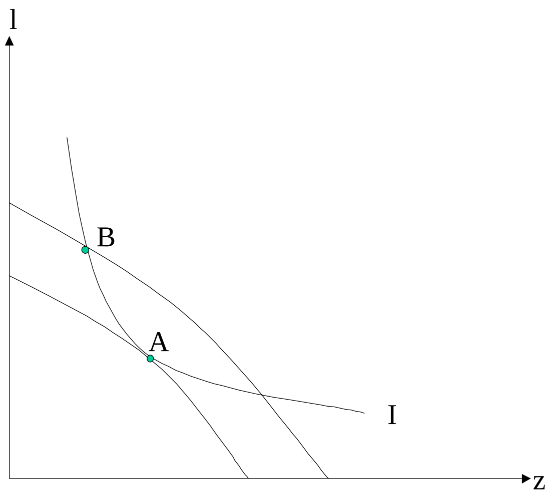

Figure 6: The second best $(l; z)$ choice when R_j is not observable

This result is in contrast with that obtained in the previous subsection. As opposed to the case where the government does not observe ability, here it knows that individual 2 relatively prefers to have a higher retirement age than individual 1 for a given gross life cycle income (the slope of the iso-effort curve is greater for individual 2 in the $(z; y)$ space). The optimal allocation in case of asymetric information then leads to a relatively lower retirement age and a greater weekly labour supply for individual 1.

5 Numerical examples

The following functions were used: $\psi(x) = x^{1-\rho}/(1-\rho)$; $u(c) = c$; $V(l) = 1/(1-l)^{\beta}$; $R_j(z) = 1/(1-z)^{\alpha_j}$ with fixed parameters $\beta = 2$; $\rho = 2$. We assume a uniform distribution of characteristics. We present different numerical simulations where we indicate the optimal allocations (c; l and z), marginal tax rates on z and l and finally the relative marginal tax rates. Tables 1 and 2 respectively illustrate case (a) where individuals only differ in ability w_i, and case (b) where individuals differ in their health status $R_j(z)$. Finally, Table 3 presents an example with different ability and health but with negative correlation between the two.

Table 4 provides an example with three individuals corresponding to ABC on Figure 4. With that subset we expect the self-selection constraint to go downwards from A to B (healthy and more productive mimicking healthy and less productive) and from B to C (healthy and less productive mimicking unhealthy and less productive).

Note that we use a quasi-linear utility function thus assuming away income e¤ects on labor supply. This allows for focusing on the substitution e¤ect without direct or indirect (resulting from redistribution) income effects.

Table 1 considers the case where the two individuals are equally healthy but have different productivities, the gap increasing from $4/5$ to $1/2$. In this particular case, the informational problem rests on the components of y_1 namely w_1 and ℓ_1; the relative distortion goes against ℓ. One observes that ℓ decreases more than z relative to their first-best values. Naturally, there is no distortion for type 2's individuals.

When the gap between a characteristic values increases, one observes that the marginal tax T'_z and T'_y increase while the ratio zT'_z/yT'_y decreases. To understand that, let us look at the incentive compatibility constraint when the gap between w_h and w_ℓ increases.

$$u(c_2) - V(\ell_2)R(z_2) - u(c_1) + V\left(\frac{w_1\ell_1}{w_2}\right)R(z_1) = 0.$$

One clearly sees that as w_1/w_2 decreases it pays to reduce z_1 along with ℓ_1. If only ℓ_1 were allowed to change, the loss in efficiency would be higher. This is due to the convexity of both V and R.

TABLE 1: Case (a): $\alpha_1 = \alpha_2 = 2$							
		c	ℓ	z	T'_z	T'_y	zT'_z/yT'_y
(a_1): $w_1 = 200; w_2 = 250$							
Individual 1	First Best	68	0.55	0.55			
	Second Best	63	0.538	0.547	6.16	0.05	0.62
Individual 2	First Best	74	0.57	0.57			
	Second Best	78	0.57	0.57			
(a_2): $w_1 = 200; w_2 = 300$							
Individual 1	First Best	77	0.55	0.55			
	Second Best	69	0.533	0.545	9.19	0.07	0.66
Individual 2	First Best	88	0.59	0.59			
	Second Best	93	0.59	0.59			
(a_3): $w_1 = 200; w_2 = 400$							
Individual 1	First Best	95	0.55	0.55			
	Second Best	86	0.532	0.543	10.39	0.07	0.71
Individual 2	First Best	118	0.61	0.61			
	Second Best	124	0.61	0.61			

Table 2 presents the case where the two types are equally productive but have di¤erent health condition. Now the government observes y_i and thus $`_i$: The distortion is on the age of retirement of type 1. We can see that the distortion goes against $z$ which falls more than $`$.

TABLE 2: Case (b) : $w_1 = w_2 = 200$							
		c	l	z	T_z^0	T_y^0	$zT_z^0=yT_y^0$
(b$_1$): ®$_1$ = 2; ®$_2$ = 1:7							
Individual 1	First Best	64	0:55	0:55			
	Second Best	60	0:549	0:546	4:43	0:01	1:53
Individual 2	First Best	65	0:56	0:6			
	Second Best	68	0:56	0:6			
(b$_2$): ®$_1$ = 2, ®$_2$ = 1:4							
Individual 1	First Best	68	0:55	0:55			
	Second Best	62	0:546	0:538	10:62	0:03	1:45
Individual 2	First Best	71	0:58	0:66			
	Second Best	75	0:58	0:66			
(b$_3$): ®$_1$ = 2, ®$_2$ = 1							
Individual 1	First Best	75	0:55	0:55			
	Second Best	66	0:542	0:53	15:91	0:05	1:37
Individual 2	First Best	79	0:61	0:76			
	Second Best	85	0:61	0:76			

Table 3 considers two individuals corresponding to A and C on Figure 4. Whether or not z is more distorted than ` depends on the relative gaps $w_1$=$w_2$ and $R_1$=$R_2$. Not surprisingly for $w_1$=$w_2$ given, as $R_1$=$R_2$ or rather ®$_1$=®$_2$ increases, the distortion of z relative to ` increases. From < 1 to > 1:

TABLE 3: Strict negative correlation, w_1 = 200; w_2 = 240							
		c	l	z	T^0_z	T^0_y	zT^0_z=yT^0_y
®$_1$ = 2; ®$_2$ = 1:7							
Individual 1	First Best	71	0:55	0:55			
	Second Best	63	0:537	0:541	10:71	0:06	0:87
Individual 2	First Best	77	0:58	0:62			
	Second Best	82	0:58	0:62			
®$_1$ = 2, ®$_2$ = 1:4							
Individual 1	First Best	76	0:55	0:55			
	Second Best	67	0:535	0:535	14:58	0:07	1
Individual 2	First Best	84	0:60	0:68			
	Second Best	90	0:60	0:68			
®$_1$ = 2, ®$_2$ = 1							
Individual 1	First Best	85	0:55	0:55			
	Second Best	74	0:534	0:531	17:24	0:08	1:07
Individual 2	First Best	94	0:63	0:77			
	Second Best	101	0:63	0:77			

Finally Table 4 is devoted to the 3 individuals case. Going back to Figure 4 these three individuals are represented by A, B, C. Three examples are studied with the gap between R_1 and R_2 shrinking. We focus on this health gap. When the health gap is sufficiently wide, the self-selection constraints go along the sequence ABC. Type 3 is subject to no distortion. Type 2 — less productive than 1 but as healthy — is subject to the same distortion as in subcase (a): downward distortion on ℓ relatively stronger than that on z. Type 3 is subject to the same distortion as in subcase (b): downward distortion on z relatively stronger than that on ℓ. The same pattern of results holds when the health gap decreases. However, when it decreases enough, the incentive compatibility constraint between type 3 and type 1 becomes binding. In other words type 3 finds desirable to mimick type 1 and not just type 2, type 1 benefitting from an attractive early age of retirement. As a consequence the marginal tax on type 1's individuals have to compromise between two binding incentive compatibility constraints. The relative tax on z rather than increasing as the health gap shrinks and it is almost equal to 1.

TABLE 4: 3 individuals with: $w_1 = w_2 = 200; w_3 = 400:$							
		c	l	z	T^0_z	T^0_y	zT^0_z=yT^0_y
®$_1$ = 2; ®$_2$ = ®$_3$ = 1:5:							
Individual 1	First Best	145	0.764	0.618			
	Second Best	131	0.760	0.605	15.64	0.045	1.37
Individual 2	First Best	146	0.787	0.711			
	Second Best	140	0.769	0.702	19.29	0.123	0.71
Individual 3	First best	168	0.83	0.76			
	Second Best	182	0.83	0.76			
®$_1$ = 2; ®$_2$ = ®$_3$ = 1:8:							
Individual 1	First Best	135.2	0.764	0.618			
	Second Best	125	0.763	0.613	6.04	0.016	1.45
Individual 2	First Best	135.7	0.772	0.653			
	Second Best	128	0.755	0.645	17.31	0.106	0.69
Individual 3	First best	158	0.81	0.71			
	Second Best	170	0.81	0.71			
®$_1$ = 2; ®$_2$ = ®$_3$ = 1:9:(IC 31 binding)							
Individual 1	First Best	132	0.764	0.618			
	Second Best	124.2	0.762	0.615	4	0.015	1.03
Individual 2	First Best	132.3	0.768	0.635			
	Second Best	124.8	0.752	0.627	15.4	0.09	0.69
Individual 3	First best	154	0.81	0.69			
	Second Best	166	0.81	0.69			

6 Conclusion

During the last decades, a number of European countries, some more than others, have expanded their social security systems in ways which have discouraged labor market participation in old age and thus fostered early retirement. This evolution paired with a steadily increasing longevity threatens the …nancial viability of PAYG pension systems.

The question we raised at the outset is whether these disincentives to postponed activity are the result of a bad tax-transfer scheme design or the consequence of an explicit desire to achieve some redistribution in a world of asymmetric information. It is very likely that existing social security system could be better designed as regarding retirement. It remains that as we have shown in this paper redistributive social security implies distortions which induce early retirement relative to what would be the …rst-best solution.

On our research agenda there are two issues we would like to pursue as an extension of this paper. The …rst one would be to combine policy schemes based on self-selection with policy schemes based on explicit control of health conditions. If controls are not too expensive and enough accurate they could contribute in getting a social security scheme that would be less discouraging for prolonged activity.

Another issue concerns the expected increase in longevity and changes in health conditions. It is quite clear that if all individual characteristics regarding to life expectancy and resistance to larger career move up in an homogeneous way, the age of retirement for each type of individuals will also increase homogeneously. However, if for some types of work and/or some type of health problems there is little improvement, then increased longevity would imply a wider range of retirement ages. This would make the use of control even more desirable.

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Appendix

$E(I;w;®) = V(l(I;w;®))R(z(I;w;®);®)$
and
$I = wl(I;w;®)z(I;w;®)$

$$1 = w\frac{dl}{dI}z + wl\frac{dz}{dI} \qquad (A1)$$

$$0 = lz + \frac{dl}{dw}z + l\frac{dz}{dw} \qquad (A2)$$

$$0 = w\frac{dl}{d®}z + wl\frac{dz}{d®} \qquad (A3)$$

Using (A1) and the envelope theorem, one can write:

$$\frac{dE}{dI} = \frac{E}{I}"_v(l) \qquad (A4)$$

where $"_v(l) = \frac{lV^0(l)}{V(l)}$:

$$\frac{dE}{dIdw} = \frac{dE}{dw}\frac{"_v(l)}{I} + \frac{E}{I}\frac{\pm"_v}{\pm l}\frac{\pm l}{\pm w}$$

where $\frac{dE}{dw} = ¡V^0(l)R(z;®)l < 0$ using equation (A2) and the envelope theorem.

Moreover, by assumption 2, $\frac{\pm"_v}{\pm l} > 0$ and $\frac{\pm l}{\pm w} < 0$ so that $\frac{dE}{dIdw} < 0$.

In the same way, one obtains:

$$\frac{dE}{dId®} = \frac{dE}{d®}\frac{"_v(l)}{I} + \frac{E}{I}\frac{\pm"_v}{\pm l}\frac{\pm l}{\pm ®}$$

where $\frac{dE}{d®} = V\frac{\pm R}{\pm ®} > 0$ using equation (A3) and the envelope theorem.

again, by assumption 2, $\frac{\pm"_v}{\pm l} > 0$ and $\frac{\pm l}{\pm w} > 0$ so that $\frac{dE}{dId®} > 0$.