International Tax and Public Finance, 10, 419–434, 2003

The Double Dividend of Postponing Retirement

HELMUTH CREMER helmut@cict.fr
University of Toulouse (IDEI and GREMAQ), 21 Allée de Brienne, 31000 Toulouse, France

PIERRE PESTIEAU P.Pestieau@ulg.ac.be
CREPP, University of Liège, 7, Bv du Rectorat, 4000 Liège, Belgium

Abstract

Early retirement seems to plague social security systems in a number of European countries. In this paper we argue that delaying retirement may have two positive effects: it is likely to partially restore the financial balance of the system, and it may foster redistribution among retirees. To obtain such a double dividend, the benefit rule of the initial social security scheme must have the following two characteristics. First, it operates redistribution *within* generations. Second, it is "biased" and induces early retirement.

Keywords: social security reform, retirement age, implicit taxation

JEL Code: H55, H23, J26

1. Introduction

In a number of countries workers tend to retire early, "too early" as it seems. This trend appears to be due mainly to the incentives created by the retirement systems. The design of the benefit formulas typically implies an implicit tax on continued activity. Consequently, retirement often appears to be premature, at least when we use a distortionless or an actuarially fair retirement system as benchmarks. Yet, if we believe recent surveys, most people tend to declare that they are happy with the current retirement age. Obviously this makes reforms difficult.

This paper shows that when social security systems are redistributive within generations, distortions cannot be totally avoided. Nevertheless, they ought to be smaller than they are now. In other words, current distortions appear to be excessive and cannot be justified by optimal policy design. Instead, we argue that eliminating some of these distortions can be Pareto improving. However, for such a Pareto improvement to be possible, we need to pick the right counterfactual policy. Let us illustrate this point through an example.

If you ask a young Belgian worker to choose between a social security system that induces him to work up to age 62, instead of the current 57, while receiving the same benefits, he will surely opt for the latter policy that we label an *unconstrained status quo*.

If instead, you ask the same worker to choose between a social security system that induces him to work up to 62 instead of the current 57 but add that the benefits will be cut accordingly if he retires at 57, the outcome is likely to be reversed. Between a policy consisting of postponed retirement and a policy that we call a *constrained status quo* most workers will be better off with the former.

In countries where over the recent decades social security has been overly generous at the expense of future generations, the observed reaction of individuals in opinion surveys and in political elections is not surprising. It is not easy to make them understand that the (Ponzi) game is over. The iron law of pay-as-you-go social security is inescapable: the challenge of aging can only be met by raising taxes, increasing the implicit social security debt, raising the age of retirement or/and cutting benefits.[1] For a number of reasons including tax competition, the first door is closed. Sound economic analysis makes it difficult to further burden future generations. The second door is thus also closed. We are left with the last two options: increasing the activity rate of elderly workers or reducing social security benefits.

In this paper we focus on the first option, a reform aimed at increasing the age of retirement progressively. This can be insufficient; adjustment in benefits may also be required. We show that increasing the age of retirement can be a Pareto improving reform in countries where it is today particularly low.

Clearly, in a country without downward distortion on the choice of retirement, and without redistributive benefit rule, we would not obtain such an outcome. To achieve what we call the double dividend of postponing retirement, we need a downward distortion, the removal of which brings additional resources. We also need a redistributive scheme so that most of the reform's cost is borne by individuals with relatively high earnings.

The rest of the paper is organized as follows. We first provide some facts concerning the falling participation rate of elderly workers and the ensuing declining effective retirement age. Then, we discuss the notion of an optimal retirement age. We show that in a second-best setting distortions are unavoidable if there is some redistributive objective. Yet, as we argue there are ways of minimizing those distortions. In the last section we show that decreasing some of the distortions that induce early retirement may result in more revenue to finance social security, and in more income equality among the retirees.

2. The Retirement Decision

2.1. Facts about Early Retirement

Before discussing reform it is important to grasp the factual features of the retirement question. First, as Table 1 shows, the effective age of retirement has been steadily decreasing over the last 50 years. Today the effective retirement is much below the so-called normal retirement age, that is 65 in most countries. The effective retirement age is a synthetic measure of the rate of participation of workers aged 50 and more. In other words it is a summary statistics for a complex retirement pattern starting at age 50.

Aging always comes to mind when talking of retirement. It results in part from a drop in fertility, but mainly from a steady increase in longevity. In the European Union the proportion of individuals above age 70 was 0.11 in 1995; in 2050 it will be 0.22. Table 2 provides detailed data on this for seven countries. It shows that the demographic dependency ratio will double in some countries by 2050.

Table 1. Longevity and effective retirement age in the European Union (1960–1995).

	Men				Women			
	Life expectancy		Retirement age		Life expectancy		Retirement age	
Countries	1960–65	1995–2000	1960	1995	1960–65	1995–2000	1960	1995
Belgium	67.9	73.8	63.3	57.6	73.9	80.6	60.8	54.1
France	67.6	74.2	64.5	59.2	74.5	82.0	65.8	58.3
Germany	67.4	73.9	65.2	60.5	72.9	80.2	62.3	58.4
Ireland	68.4	73.6	68.1	63.4	72.3	79.2	70.8	60.1
Italy	67.4	75.0	64.5	60.6	72.6	81.2	62.0	57.2
Spain	67.9	74.5	67.9	61.4	72.7	81.5	68.0	58.9
Sweden	71.6	76.3	66.0	63.3	75.6	80.8	63.4	62.1
UK	67.9	74.5	66.2	62.7	73.8	79.8	62.7	59.7

Source: United Nations Population Division, World Population Prospects, 1998; Blondal and Scarpetta (1998a, 1998b).

Table 2. Increasing dependency ratio.

	1995					2050				
	Fraction of people at least aged									
Countries	50	60	70	80	90	50	60	70	80	90
Germany	34.6	20.7	10.5	4.1	0.4	47.9	35.0	21.7	10.6	1.5
Spain	31.0	20.6	10.2	3.3	0.4	48.8	37.1	24.7	10.4	1.7
France	29.7	20.0	10.3	4.2	0.6	44.8	33.0	21.0	10.1	2.1
Ireland	24.4	15.3	8.0	2.5	0.3	46.1	33.0	19.9	8.1	1.3
Italy	34.4	22.2	11.1	4.0	0.4	50.7	38.3	26.0	12.0	1.9
UK	31.2	20.5	11.2	4.0	0.5	44.5	31.7	19.6	9.5	1.7
Sweden	33.6	22.1	12.9	4.6	0.6	41.8	29.1	18.1	8.5	1.5
EU 15	32.2	20.6	10.6	3.9	0.5	46.3	33.9	21.7	10.1	1.7

Source: Calot and Sardon (1999).

This trend has dramatic implications for the social security system. Roughly speaking and everything else being equal, it follows that either the average contribution rate has to double or the average replacement ratio has to be cut by one half. Why not then consider an increase in the age of retirement? Is it not strange to observe that, whereas life expectancy is rising, the effective age of retirement has been steadily decreasing over the last 50 years, as shown in Table 1. In other words, the problem is not just demographic; it is also social and political.[2]

The trend towards early retirement has different causes. It can be explained by economic growth—after all, leisure is a normal good—and by changes in preferences. However, the bulk of the explanation seems to rest on the incentive structure implied by social protection programs aimed at elderly workers: unemployment insurance, disability insurance, early retirement schemes, pension plans.

To represent this incentive structure we use an extremely simple model that allows us to introduce the concept of implicit taxation and of the optimal age of retirement. We don't try to explain why the system of social security is what it is. We understand that a number of features such as early retirement programs or laxist unemployment and disability insurance may be in part explained by the demand side of the labor market. Political economy considerations offer additional or alternative justifications. There are a number of papers trying to explain why a majority of voters may have pushed for a system that today is considered as unfit to meet economic and demographic challenges ahead.[3]

2.2. A Simple Model

We use a two-overlapping-generations model. Individuals of type i have productivity w_i and represent a proportion π_i of the population. They work the first period of life with length normalized to 1. They also work a fraction z_i of the second period (also of length 1) and retire for a period $h - z_i$, where h (≤ 1) denotes life expectancy. Total life thus lasts $1 + h$ and active life $1 + z < 1 + h \leq 2$. In the first period, they consume c_i and in the second d_i. An individual's lifetime utility is given by:

$$u_i = u(c_i, d_i, z_i)$$

or, with the budget constraint,

$$u_i = u(w_i - s_i, wz_i + Rs_i, z_i),$$

where s_i is saving and R is a financial interest factor. For the sake of simplicity, we will use a separable form with a quadratic disutility of work:

$$u_i = u(c_i) + \beta u\big(d_i - z_i^2/\gamma_i\big), \tag{1}$$

where $u(\cdot)$ is strictly concave, β is a time preference factor and $1/\gamma$ gives the intensity of preferences for early retirement.[4] This parameter γ can be viewed as measuring the capacity to work long time. In other words, it is a health rather than a taste parameter. Note that z_i cannot exceed a ceiling $\bar{z}$; by assumption $z_i < \bar{z} < h$.

In a *laissez-faire* setting each individual chooses z_i such that:

$$\frac{\partial u}{\partial d_i} w_i = -\frac{\partial u}{\partial z_i}$$

or with our particular function:

$$z_i = \frac{\gamma_i\, w_i}{2}. \tag{2}$$

The more productive the worker, the later he retires. Also the healthier he is the longer he can work. Recall that with our quasi-linear utility function, there is no income or wealth effect in the choice of z. With a more general utility, one would expect z_i to decrease with a wealth gain such as that arising from intergenerational transfers.

Let us now introduce a PAYG pension scheme with payroll tax rates of τ and a benefit p which for simplicity is assumed to be uniform but partially related to the retirement age. We can now write the utility function as:

$$u_i = u\big(w_i(1-\tau) - s_i\big) + \beta u\big(Rs_i + w_i z_i(1-\tau) + p(1-\alpha z_i) - z_i^2/\gamma_i\big),$$

where α is a parameter giving the relation between pension benefits and the age of retirement. When $\alpha = 0$, aggregate pension benefits are independent of the age of retirement; when $\alpha = 1$, p represents yearly benefits. Now the age of retirement is given by:

$$z_i = \frac{\gamma_i}{2}\left[w_i(1-\tau) - \alpha\right] \tag{3}$$

or

$$z_i = \frac{\gamma_i}{2} w_i(1-\theta_i) \tag{4}$$

with

$$\theta_i = \tau + \frac{\alpha p}{w_i}, \tag{5}$$

where this parameter θ_i is the famous implicit tax on prolonged activity.

2.3. The Implicit Taxation

This simple model yields predictions which are in line with observed behavior. In particular, the age of retirement increases with the wage rate and with health and decreases with the parameter θ_i which can be interpreted as the implicit tax on prolonged activity. It includes the payroll tax as well as the foregone benefits. This parameter θ_i decreases with w_i and this is also what is observed. It depends on α; in some countries α is close to 0, in other words yearly pension benefits does not increase much when workers retire late. The higher α the stronger the distortion on the choice of the age of retirement.

The importance of this implicit tax varies quite a lot across countries, and this variation explains in great part why effective retirement shows such a wide range among the OECD countries. Figure 1 presents the international comparison of Gruber and Wise (1999) which shows a tight relation between implicit taxation and insured capacity. The indicator of implicit taxation is the sum of the implicit taxes an elderly worker faces at each age during the relevant period (55–65). The unused capacity indicator is actually one minus labor force participation of workers between 55 and 65.

In view of ever increasing longevity, it would seem natural to reverse the evolution towards early retirement. Such reforms face serious opposition. A number of countries have been experiencing serious difficulties with their implementation, despite an abundance of national and international expert reports indicating the necessity to move quickly.[5] Survey results on this issue are quite interesting. Over the years they continuously show a majority in favor of the *status quo*. In Boeri, Börsch-Supan and Tabellini (2000) and Boeri et al. (2001) which deals with Germany, Italy, France and Spain, one finds that a majority of respondents does not want any rolling back of their social security system. Table 3 gives the desired and the expected age of retirement for France and Belgium. In both countries, young workers would like to retire even earlier than today, but expect that this will not be possible. The older workers have a narrower gap between the desired and the expected age of retirement.

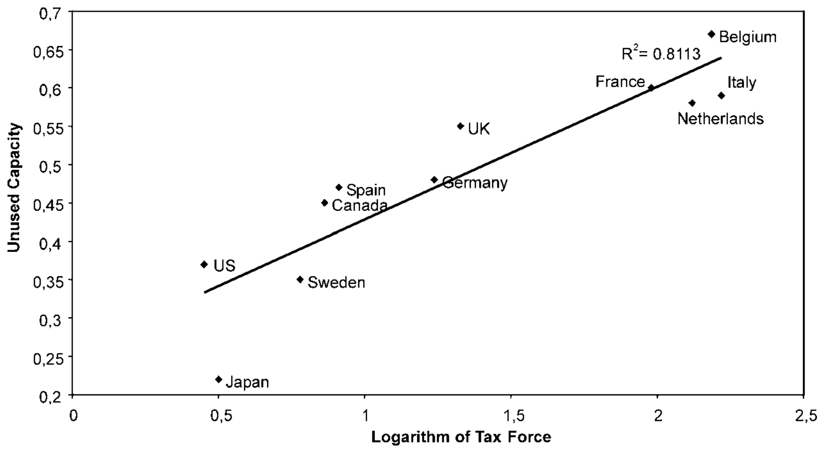

Figure 1. Implicit tax and unused capacity. Source: Gruber and Wise (1999).

Table 3. Desired and expected retirement age in France and Belgium.

France			Belgium		
Age class	Desired	Expected	Age class	Desired	Expected
18–34	54.3	62.2	< 25	55	60
50–64	56.4	60.3	> 50	59	60

Source: Assous (2001), De Vits (2002).

Table 4. Costs of early retirement in some OECD countries as a share of potential GDP (in %).

Countries	1980	1990	1998
Belgium	–	15.2	13.5
Germany	7.7	9.5	10.9
France	6.2	11.3	10.5
Netherlands	8.1	10.5	10.1
Spain	4.8	9.7	9.2
UK	–	7.5	7.6
Sweden	5.9	4.7	4.8
USA	5.8	5.4	4.7
Japan	2.9	4.7	4.8

Source: Herbertsson and Orszag (2001).

Why do we want to raise the age of retirement? For two related reasons. First, given the demographic dependency ratio, which is going to double in the next 3–4 decades, it is important to move in that direction to avoid a financial crisis of social security systems. Second, there is a cost for so much inactivity. Table 4 provides an estimate of the cost of early retirement in terms of GDP. Not surprisingly, the cost is high where people stop working early.

3. Is there Such a Thing as an Optimal Age of Retirement?

3.1. Several Retirement Ages

The term retirement age, is used in a variety of ways.[6] There is the age at which a worker is entitled to benefits labeled full or normal benefits. This is referred to as the *normal age of retirement* (65 for men in most European countries). There is also the age at which a worker is first eligible for some retirement benefits; this is called the *early entitlement age* (60 in most countries). In addition to these there are entitlement ages for early retirement schemes (below 60 and varying across sectors). Unemployment and disability insurance do not have an entitlement age, although in many countries an unemployed worker is treated differently when he is above a certain age (55, for instance).

What really matters is the *effective retirement age* which varies across workers according to a number of individual or sectorial characteristics. For example, people tend to retire later if they are healthy or relatively more productive. In general, the self-employed retire later than salaried workers. In the same way as the effective retirement age varies across individuals, the *optimal age of retirement* varies also quite a lot.

3.2. Optimal Retirement Age

In a *laissez-faire* economy, that is a market economy without social security, people tend to choose to retire when the marginal utility of one year of retirement is equal to the consumption value of one more year of work. As we have seen in the previous section, with a quadratic disutility we obtain:

$$z_i = \frac{\gamma_i}{2} w_i.$$

Interestingly, this is also the condition that defines the (first-best) optimal age of retirement. With the quasi-linear specification the age of retirement is unaffected if an optimal retirement system is introduced. With a more general utility function allowing for income effects, high productivity workers would retire later and low productivity workers would retire earlier than in the *laissez-faire*.

However, in the real world we have distortions that can be summarized by the concept of implicit tax. Now the retirement age is given by expression (4) and we have

$$z_i = \frac{\gamma_i}{2} w_i (1 - \theta_i),$$

where θ_i, defined by (5), includes the double burden of a standard social security system: the payroll tax and the foregone pension benefits. Note that the level of these foregone benefits varies substantially across countries. In particular, it depends on the more or less contributory nature of the system and on its actuarial fairness. With a pure Bismarckian system we have $\theta_i = 0$. Without going that far, one often defines actuarial fairness as the neutrality of social security entitlements with respect to the age of retirement. In the present setting, this implies $\alpha = 0$ and we have $\theta_i = \tau$. We are then left with the distortion arising from the tax system.

Again we do not want to explain why different countries have different implicit taxes. This question is outside the scope of this paper. In a democracy tax and social security systems hopefully result from majority voting but each individual's vote may be influenced by a number of considerations pertaining to the labor market or to specific views of equity.

What we know is that for demographic reasons current social security systems have to go through drastic reforms. Assume that we have a social security system represented by τ, p and α. The link between contributions and benefits is irrelevant at this point. In the simple model used here, "weekly" labor is inelastic; only the age of retirement z_i is endogenous.

Given this, a natural way out is to differentiate τ according to the periods with $\tau_1 > \tau_2$ and to set α to 0 while keeping the overall budget constraint balanced. The reason is simple: taxing young workers implies no deadweight loss. At that age it is surely not an option to retire from the labor force. On the contrary, taxing workers after 55 distort their retirement choice. It is thus not surprising that in recent years there have been a number of studies considering an age-related tax policy.[7]

In the appendix we study these issues by way of our simple model introduced in Section 2.2. We derive the second-best optimal pension scheme (payroll taxes and benefit rule). We show that for redistributive reasons, some taxation in the second period remains desirable with a downward distortion on z_i. This is the unavoidable distortion referred to above.

However, we also obtain the intuitive result that the tax is much higher in the first than in the second period. This is because taxing first period income does not affect the decision and thus implies fewer distortions. The only reason why there is a tax in the second period, when retirement is an option, is that this is a way to redistribute resources from highly productive workers to less productive ones.[8] Consequently, we obtain that a reform towards age dependent taxation, with $\tau_1 > \tau_2$, starting from an (otherwise optimal) uniform policy (with payroll tax $\tau = \tau_1 = \tau_2$) is welfare improving.

3.3. Avoidable Distortions

Recalling that with a pure contributory system there would be no distortion, and that by definition such a system cannot be redistributive, we realize that redistribution is a potential cause of the problem. At the same time we observe that redistribution is not the only reason for high implicit taxes. A country like Sweden has a social security system that is more redistributive than the French or the German one and yet it has a higher rate of activity among its older workers. Table 5 presents data on implicit taxation (taxes are cumulated over time) and poverty measures. There is little relationship between those two variables.

If the implicit taxation cannot be justified by redistributive concerns, how can it be explained? It can be the consequence of poorly designed tax/benefit incentives. It can also result from the desire to favor youth employment by forcing older workers out of the labor force. Poorly designed tax/benefit incentives are not unusual. As to the policy of encourag-

Table 5. Retirement, implicit taxation, poverty and unemployment.

Countries	Unused labor force (55–65) in %	Men retired at 59 (%)	Implicit tax on postponed activity	Poverty rate (50%)		Unemployment rate (1999)	
				Total	Elderly	Total	15–24
Belgium	67	58	887	8.2	12.4	8.7	22.6
France	60	53	725	8.0	9.8	11.8	26.5
Italy	59	53	920	14.2	12.2	11.5	31.1
Netherlands	58	47	832	8.1	6.4	3.6	7.4
UK	55	38	377	13.4	13.7	6.1	12.3
Germany	48	34	345	7.5	7.0	8.7	8.2
Spain	47	36	249	10.1	11.3	15.7	28.3
Sweden	35	26	218	6.6	2.7	7.1	14.2

Source: Gruber and Wise (1999), Atkinson and Bourguignon (2000).

ing youth employment through early retirement schemes, it was popular in some countries some years ago but it is now acknowledged to be quite ineffective, and therefore can be attributed to poor design.[9] Table 5 shows that there is no link between implicit taxation and youth unemployment.

To put it differently we believe that today the only extenuating circumstance for implicit taxation of postponed work is redistribution, and that, therefore, countries with high implicit taxes could easily reduce them. As we show in the next section, such a reform may in some instances generate a double dividend.

The double dividend can be obtained from our simple model. In the appendix, we have already shown that an increase in (effective) retirement age, induced by a reduction in the implicit tax can be welfare improving (with a utilitarian objective). This in itself is an argument in favor of reform. However, the idea of double dividend we refer to is stronger. Our point is that the increase in retirement age (the decrease in implicit taxes) may actually result in a Pareto improvement. This comes about because the able and healthy are better off since they face a smaller implicit tax (and choose to work longer). The poor and unhealthy, on the other hand, are not (or not much) affected by the implicit tax because they will continue to retire early. However, they gain because the continued activity of the more able generates more tax revenues and thus higher pension benefits. Observe that this second effect, relies of course on the redistributive character of the pension system.

To make this point in the simplest possible way we consider an even simpler version of our model and assume that there are just two types of individuals with $w_2 > w_1$, and $\gamma_1 = 0 < \gamma_2 = 1$. We start with $\alpha > 0$ and τ high enough. We now consider a policy aimed at increasing the age of retirement by working on incentives without increasing the payroll tax. We now distinguish the payroll tax in the first (τ_1) and in the second period (τ_2). We set $\tau_1 = \tau$ and try to derive the value of τ_2 which maximizes the value of p. The revenue constraint is given by

$$p(1 - \alpha\pi_2 z_2) = \bar{w}(1 + m)\tau_1 + \pi_2 w_2 z_2 \tau_2, \qquad (6)$$

where π_2 is the proportion of workers of type 2 and $\bar{w}$ is the average wage. Because $\gamma_1 = 0$, $z_1 = 0$; $z_2 = (w_2(1 - \tau_2) - \alpha p)/2$. Differentiating (6) yields:

$$\frac{\mathrm{d}p}{\mathrm{d}\tau_2} = \frac{\pi_2 w_2^2(1-2\theta_2)\gamma_2}{2-\pi_2\alpha\gamma_2(1-2\theta_2)}.$$

Thus the maximum value of p for τ_1 and α given is reached for

$$\tau_2^* = \frac{1}{2} - \frac{\alpha p}{w_2}.$$

Assuming $\tau_2^* < \tau_1 = \tau$, this implies that, starting from a uniform policy with $\tau_2 = \tau_1 = \tau$, additional resources can be collected without diminishing the welfare of type 1 individuals and increasing that of type 2 individuals. These will work more and earn more enjoying more utility. Let us denote $\Delta p = p(\tau_2^*) - p(\tau)$ the amount of additional resources. When there is a demographic shock they can be used to meet the increase in the dependency ratio. We show in the next section, on the basis of microsimulation model, that such a reform (decreasing τ_2 or alternatively fostering the age of retirement) is preferable to a uniform cut in benefits. Here the percentage cut in benefits would be equal to $\Delta p/p(\tau)$. Admittedly, this is a very particular example which mainly rests on the assumption that an initial distortion ($\tau > \tau_2^*$) and a redistributive pension system exist (here uniform pension benefits).

4. Increasing the Effective Retirement Age

4.1. The Right Alternative

As we show above, raising the age of retirement is not very popular among either young or elderly workers. It is thus a very delicate matter for a government to reform the pension system in that direction even though increasing rates of dependency make it urgent to move quickly.

In our view people are not considering the right alternative. Or to put it another way, they are not using the correct counterfactual. To use an analogy, workers who are asked to choose between a 40 hour versus a 35 hour work week, at the same *weekly* income, will choose the shorter work week. On the other hand, if they have to choose between the two work weeks with the same *hourly* wage, the outcome is far less obvious; a preference for the longer work week can then not be ruled out.

Quite often, when people are asked to choose between the *status quo* in terms of benefits and retirement age and a new regime with postponed retirement and about similar benefits (yearly pension) they will most likely choose the *status quo*. This is individually rational. However this decision is based on an unrealistic alternative. With the dependency rate reaching its peak in a couple of decades benefits will have to be cut, if both contributions and retirement do not change. This is the iron law of pay-as-you-go systems. There was a time when one could escape this iron law by shifting the financial burden to future generations. But today this is less and less possible.

The correct counterfactual is not an unconstrained *status quo* but a constrained one with constant retirement pattern but fewer benefits. To make the two situations comparable, we must realize that the unconstrained *status quo* is unrealistic: benefits have to be cut by an amount equal to the additional revenue generated by postponing the age of retirement.

4.2. The Case of Belgium: A Double Dividend

Following the methodology applied in the NBER International Social Security Project, we consider a reform under which the various statutory ages of retirement are increased by 3 years.[10] The most notable ages in Belgium are the normal retirement age of 65 and the early entitlement retirement age of 60, which basically means that workers can draw benefits at 60, these benefits being full if they have had a complete career. Increasing these two ages by three years doesn't mean that all workers will retire three years later. Their retirement decision is surely influenced by the reform but also by other considerations such as the other parameters of the system, their health, their spouse's income, etc.

Now we look at the impact of such a reform on the lifetime disposable income of a cohort of workers aged 50 starting from that age until the end of their life. Table 6 shows the increase in effective retirement age due to this reform, labeled Reform 1. It concerns both men and women and five income classes. The average variation is 2.9 years.

Reform 1 will save a certain amount of money due to the increase in Social Security contributions, and to the reduction in the benefits payment length. (The other taxes are not taken into account in this exercise.) This amount could be used to finance aging and can be expressed in percent of the sum of retirement benefits. In our case the saving is equal to 21.32% of retirement benefits. We now compare this scenario to one without reform, but with a budget reduction of 21.32%. This budget reduction can be obtained by a uniform reduction of 21.32% of retirement benefits. This scenario is called 'Reform 0.' Now we will compare the redistributive impact of these two reforms on the rate of poverty.[11]

In order to measure this impact we take the number of individuals who are under the poverty line, the poverty line being 50% of the median income in the baseline. We also take 60% of the median income in the baseline. Table 7 shows that the number of individuals under the poverty line does not increase under Reform 1, whereas it increases largely under Reform 0.

There are clearly differences between a theoretical approach such as that presented in the appendix and these empirical findings. Our theoretical model is terribly simplistic. The tax-benefit schedule is linear. There is a lot of monotonicity among the individual characteristics, productivity and health, and the implicit tax, the level of benefits or the age

Table 6. Average retirement age.

Income quintile	Baseline	Reform 1	Variation
1	57.7	60.3	2.6
2	57.4	60.2	2.8
3	57.6	60.5	2.9
4	58.3	61.4	3.1
5	59.6	62.7	3.1

Table 7. Percentage of individuals under the poverty line.

Baseline	Reform 0	Reform 1
	50% of the median income	
4.42	7.95	4.48
	60% of the median income	
10.09	16.21	8.96

of retirement. The welfare of individuals is expressed in terms of utility. By contrast, our empirical model is a very intricate black box with actual individuals and actual institutions. It sometimes yields surprising results because no relationship is monotonic. Questions such as marital status, completeness of the work career, and type of occupation matter a lot. Furthermore, our welfare indicator is lifetime income and not utility. In other words, the disutility of working one more year is not taken into account.

5. Conclusion

In this paper we have argued that delaying retirement ages might have a double dividend effect. First, it will free resources needed to meet the challenge of ageing. Second, in countries with redistributive social security schemes, it will improve the lifetime welfare of those with low wages and poor health. In assessing such a reform we use a counterfactual policy with unchanged contribution rates and retirement age, but with a cut in pension benefits.

There is an aspect that has been neglected in the above analysis: the working of the labor market. It is clear that prolonging activity will call for a reform of labor market rules, such as the seniority rule and the still entrenched tradition of one job one life. Another aspect that was overlooked is the idea that reforms do not have to be linear. It is unrealistic to assume that the reply to aging would be a uniform reduction in benefits. One could hope that if benefits have to be cut the reduction would be lighter for lower retirement benefits.

Appendix

In the appendix we use our simple model to provide a formal treatment of the points which are sketched in Section 3.2. We characterize the second-best optimal pension scheme and derive payroll taxes and benefit rule. Assuming $R = (1 + n)$, we then show that the optimum implies $\tau_1 > \tau_2 > 0$ and that a small decrease in τ_2, starting from the optimum uniform tax $\tau = \tau_1 = \tau_2$, is welfare improving. The same result also arises when $R - (1 + n) > 0$, but not too large.

The resource constraint is given by

$$\left(1 - \alpha \sum_i \pi_i z_i\right) p = \tau_1 \sum_i \pi_i w_i (1 + n) + \tau_2 \sum_i \pi_i w_i z_i. \tag{7}$$

Denoting average income by $\bar{w} = \sum_i \pi_i w_i$ and rearranging yields:

$$p = \tau_1 \bar{w}(1+n) + \sum_i \pi_i \theta_i w_i z_i,$$

where n is the population growth rate and the return to a PAYG system while θ_i is the implicit tax defined by (5). Retirement age z_i is chosen by the individual and given by (4).

We now determine the optimal second-best pension system. We consider two possibilities: same tax rate $\tau = \tau_1 = \tau_2$ over the two periods and differentiated tax rates $\tau_1 \neq \tau_2$. With a utilitarian social welfare function, the problem of the social planner can be represented by the following Lagrangian:

$$\mathcal{L} = \sum_i \pi_i \left[u\big(w_i(1-\tau_1) - s_i^*\big) + \beta u\left(\gamma_i \frac{w_i^2(1-\theta_i)^2}{2} + p + Rs_i^* \right) \right] + \mu \sum_i \pi_i \left[w_i \left((1+n)\tau_1 + \gamma_i \, \frac{w_i(1-\theta_i)\theta_i}{2} \right) - p \right],$$

where s_i^* denotes the optimal saving level resulting from $-u'(c_i) + \beta u'(d_i)R = 0$. For simplicity, liquidity constraints are ignored; negative savings are not ruled out. If we also assume $\beta R = 1$ we then have $u'(c_i) = \beta R u'(d_i) = u'(d_i)$.

When tax rates are allowed to differ between periods, the FOC for a social optimum are:

$$\frac{\partial \mathcal{L}}{\partial \tau_1} = -\sum_i \pi_i w_i u'(c_i) + \mu(1+n)\bar{w}, \tag{8}$$

$$\frac{\partial \mathcal{L}}{\partial \tau_2} = -\sum_i \pi_i w_i^2 \gamma_i \left[\beta u'(d_i)(1-\theta_i) - \mu \frac{1-2\theta_i}{2} \right] = 0, \tag{9}$$

$$\frac{\partial \mathcal{L}}{\partial p} = \sum_i \pi_i \beta u'(d_i) - \mu + \sum_i \pi_i w_i \gamma_i \alpha_i \left[\beta u'(d_i)(1-\theta_i) - \mu \frac{1-2\theta_i}{2} \right] = 0. \tag{10}$$

Expression (10) is not easy to interpret because of α which makes p not just a lump-sum transfer but a linear levy. To simplify the interpretation, we assume $\alpha = 0$.

With $\alpha = 0$, combining (8) and (10) yields:

$$\frac{\partial \mathcal{L}}{\partial \tau_1} = -\sum_i \pi_i u'(d_i)\big[Rw_i - (1+n)\bar{w}\big] = -\sum_i \pi_i u'(d_i) R(w_i - \bar{w}) - \big(R - (1+n)\big)\bar{w} \sum_i \pi_i u'(d_i). \tag{11}$$

The first term of the RHS of (11) is positive as the covariance between $u'(d_i)$ and w_i is negative. The second term is nil or negative if $R \geq 1+n$, which is generally assumed.

Consequently, for $R = 1 + n$ we obtain $\tau_1^* = 1$.[12] When $R > 1 + n$, on the other hand, redistributive benefits of the uniform pension are mitigated by the lower return from PAYG rather than from savings and $\tau_1^* < 1$ can no longer be ruled out.

The other tax rate depends on the quadratic distortion. It can be shown to be equal to:

$$\tau_2^* = \frac{-\text{cov}(u'(d_i), w_i^2)}{-\text{cov}(u'(d_i), w_i^2) + Ew_i^2 Eu'(d_i)} < 1.$$

Summing up, when $R = 1 + n$ we have $1 = \tau_1^* > \tau_2^*$. The same result holds when $R > 1 + n$, but not too large. For large R, $\tau_1^* < 1$ cannot be ruled out, but it is clear even then an extreme assumption would be needed to generate a case where $\tau_1^* < \tau_2^*$ would arise. For simplicity we concentrate on the case where $\tau_1^* = 1$.

Let us now assume that, for whatever reason, the two taxes are to be equal: $\tau_1 = \tau_2 = \tau$. Then the FOC with respect to τ is given by a combination of (8) and (9):

$$\frac{\partial \mathcal{L}}{\partial \tau} = -\sum_i \pi_i w_i \big[u'(c_i) + \beta u'(d_i)\gamma_i w_i (1-\tau)\big] + \mu\left[(1+n)\bar{w} + (1-2\tau)\sum_i \pi_i \gamma_i w_i^2\right] = 0.$$

This is equivalent to writing:

$$\left.\frac{\partial \mathcal{L}}{\partial \tau}\right|_{\tau_1=\tau_2} = \frac{\partial \mathcal{L}}{\partial \tau_1} + \frac{\partial \mathcal{L}}{\partial \tau_2},$$

with $\partial\mathcal{L}/\partial\tau_1 > 0$ and $\partial\mathcal{L}/\partial\tau_2 < 0$.[13] By forcing the two tax rates to be equal, we have a too high rate in the second period when distortions are strong and a too low rate in the first period. It then follows that starting from the optimal uniform tax $\tau_1 = \tau_2 = \tau^*$ and moving to $\tau_2 < \tau_1$, one can increase social welfare. Note that this policy reform may even increase the lifetime utility of everyone. In particular, as long as the optimal single τ is above the tax rate maximizing the Laffer curve, one can collect more resources and increase the welfare of all including the poor by a marginal decrease of τ_2 starting from $\tau_2 = \tau^*$. This latter point is further developed in Section 3.3.

Acknowledgment

We are grateful to two referees for helpful comments.

Notes

1. See Cremer and Pestieau (2000).
2. See Cremer and Pestieau (2000).
3. See, e.g., Casamatta, Lozachmeur and Pestieau (2002), Conde-Ruiz and Galasso (2000).

4. We realize that both separability and quasi-linearity are strong assumptions for the problem at hand. They are mainly made for reasons of simplicity. It is clear that without income effect we miss some of the effects of redistribution on the relevant decision.
5. Among the most recent example, there is the series of OECD studies on how to improve labor markets prospects for older workers in about 20 countries. See, e.g., OECD (2003).
6. See Diamond (2002).
7. See Lozachmeur (2002), Kremer (1997). For the joint choice of weekly labor and retirement, see Cremer, Lozachmeur and Pestieau (2002).
8. In a related paper, Jensen, Lau and Poutvaara (2002) argue that a Bismarckian system with actuarial adjustment may dominate a Beveridgean system that is heavily distorted. They show that even low-ability socio-economic groups benefit from such a shift.
9. See on this Boldrin et al. (1999).
10. Dellis et al. (2001).
11. We use the poverty rate as a measure of redistribution. We realize that this is a partial measure. Indeed in this illustration, as well as in the theoretical example of the previous section, the reform does not improve the standard measure of inequality.
12. Recall that we have not liquidity constraints; otherwise $\tau_1^* < 1$ would be required to have a positive consumption in the fist period.
13. Recall that we assume $\tau_1^* = 1$ so that the first term is always possible. When $1 > \tau_1^* > \tau_2^*$ some additional regularity condition are required to obtain the result.

References

Assous, L. (2001). "Les opinions des Français au début 2000 en matière d'âge de départ à la retraite." *Etudes et Résultats*, 150. Paris: Ministère de l'Emploi.

Atkinson, A. and F. Bourguignon. (2000). "Income Distribution and Economics." In A. Atkinson and F. Bourguignon (eds.), *Handbook of Income Distribution*. Amsterdam: North-Holland, pp. 1–58.

Blondal, S. and S. Scarpetta. (1998a). "Falling Participation Rates among Older Workers in the OECD Countries." Paris: OECD.

Blondal, S. and S. Scarpetta. (1998b). "The Retirement Decision in OECD Countries." OECD-EDWP 202.

Boeri, T., A. Börsch-Supan and G. Tabellini. (2000). "Would You Like to Shrink the Welfare State?" *Economic Policy* 32, 7–50.

Boeri, T., A. Börsch-Supan, A. Brugavini, R. Disney and F. Perrachi. (2001). *Pensions: More Information, Less Ideology*. Dordrecht: Kluwer.

Boldrin, M., J.-J. Dolado, J.-F. Jimeno and F. Perrachi. (1999). "The Future of Pension in Europe." *Economic Policy* 29, 289–320.

Calot, G. and J.-P. Sardon. (1999). "Vieillissement démographique et protection sociale." *Futuribles* July-August, 19–45.

Casamatta, G., H. Cremer and P. Pestieau. (2002). "Voting on Pensions with Endogenous Retirement Age." Unpublished.

Conde-Ruiz, J. I. and V. Galasso. (2000). "Early Retirement." CEPR Discussion Paper # 2589.

Cremer, H. and P. Pestieau. (2000). "Reforming Our Pension Systems: Is it a Demographic, Financial or Political Problem?" *European Economic Review* 44, 974–983.

Cremer, H., J.-M. Lozachmeur and P. Pestieau. (2002). "Social Security and Variable Retirement Schemes." An Optimal Income Taxation Approach." Unpublished.

Dellis, A., R. Desmet, A. Jousten and S. Perelman. (2001). "Micro-modelling of Retirement in Belgium." Unpublished.

De Vits, E. (2002). *L'homme et le travail. La vision des jeunes, des actifs et des inactifs*. Bruxelles: Randstad Belgium.

Diamond, P. (2002). *Social Security Reforms*. Lindhal Lectures. Oxford University Press.

Gruber, G. and D. Wise. (1999). *Social Security and Retirement around the World*. Chicago: The Chicago University Press.

Herbertsson, T. and J. M. Orszag. (2001). "The Cost of Early Retirement in the OECD." Reykjavik: Institute of Economic Studies, WP # 01.02.

Jensen, S., M. Lau and P. Poutvaara. (2002). "Retiring Europe: An Assessment of Alternative Social Security Rules." Mimeo.

Kremer, M. (1997). "Should Taxes be Independent of Age?" NBER Working Paper 6304.

Lozachmeur, J.-M. (2002). "Three Period Optimal Income Taxation." CORE Working Paper, 2002/46.

OECD. (2003). "Older but Wiser: Policies to Improve Labor Markets Prospects for Older Workers in Belgium." Forthcoming.