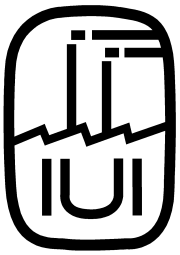

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Pensions and Contemporary Socioeconomic Change

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ABSTRACT

The paper discusses the consequences for the functioning of different pension systems of various types of socioeconomic changes, mainly demographic developments, variations in productivity growth and changes in real interest rates. Two of the pension systems have exogenous and four have endogenous contribution rates. I analyze both marginal and radical pension reforms for the purpose of making pension systems more stable, avoiding arbitrary redistributions between generations and dealing with increased heterogeneity of the population in terms of family structure and international mobility. The advantages of combining PAYGO and actuarially fair systems are pointed out.

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PENSIONS AND CONTEMPORARY SOCIOECONOMIC CHANGE*

Contemporary pension systems in developed countries reflect economic, social and political conditions in the 1930s and the first decades after World War II. Recently, new socioeconomic conditions have created both rationales and political forces for revisions of existing pension systems. Changes in demography, real wage growth and real interest rates are obvious examples. Increased heterogeneity and instability of the family, higher labor force participation of women, increased diversity of individual life cycles, greater international mobility of labor and capital, and ambitions to encourage individual responsibility also have important implications for pension systems. Moreover, some socioeconomic changes have been induced by the pension system itself via (endogenous) behavioral adjustments of individuals, with feedback effects on the pension system.

When discussing these issues, it is useful to set up a more elaborate classification of pension systems than the usual distinction between defined-benefit (DB) and defined-contribution (DC) systems. The choice of an appropriate taxonomy depends, of course, on the issues to be raised. One question that is focused on in this paper concerns the consequences of socioeconomic changes for the intergenerational distribution of income and the sharing of income risk among generations. The distinction between pension systems with exogenous and endogenous contribution rates (tax rates) then becomes crucial. However, when analyzing socioeconomic changes that are induced by the pensions arrangements themselves, other distinguishing features of pension systems have to be taken into account. These include the degree to which the systems are pay-as-you-go ("pay-go" for short) and funded, respectively, whether the systems have individual

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accounts and whether pension payments are lump sum, a fraction of previous individual earnings or contributions, or a fraction of current average earnings.

Against this background, six generic pension systems are classified in Section I. Each system can be varied considerably, both by incorporating elements from other systems and by introducing restrictions on contributions or benefits. Section II turns to the consequences, in the context of each system, of socioeconomic changes for the intergenerational distribution of income, risk sharing and macroeconomic balance. Endogenous behavioral adjustments in response to welfare-state arrangements, in particular via disincentive effects on work and saving, are also introduced. Such effects are discussed in more detail in subsequent sections, which examine alternative pension reforms aimed at mitigating disincentives. A few of these reforms are "marginal" in the sense that the existing pension system is modified (section III). Such reforms include both *ad hoc* policy measures and various automatic adjustment mechanisms. Two radical reforms are discussed in section IV, namely a shift to either a quasi-actuarial system, characterized by a strong link between contributions and benefits, or a fully funded pension system with a capital-market rate of return on the contribtions. Adjustments of various pension systems to increased heterogeneity of individuals and households are considered in section V. Section VI concludes.

I. Classification of pension systems

I begin by considering two pension systems with exogenous contribution rates and hence endogenous pension benefits: (1) a fixed-fee pay-go system with yearly budget balance and (2) a fully funded system with individual accounts and a capital-market return on the pension contributions. I then turn to four pay-go systems with fixed benefit rules and hence endogenous contribution rates: (3) a lump-sum benefit system, (4) an earnings-based system, (5) a contribution-based system and (6) a fixed (intergenerational) income-ratio system. I use the following notations:

τ = payroll tax rate
y = average labor income
N = number of employed individuals (workers)

R = number of retired individuals
B = fixed (lump-sum) pension benefit per person
$G_t = (y_t \cdot N_t)/(y_{t-1} \cdot N_{t-1})$ = rate of growth factor for labor income (tax base)
i = real interest rate on financial markets
$I = 1 + i$ = real interest-rate factor
w^j = real wage rate of individual j
h^j = hours of work of individual j.

I assume two overlapping generations, each living for two periods. For some purposes, however, it is important to divide each of these periods into several sub-periods ("years"). The schematic description below of revenues and expenditures of various pension systems should be self-explanatory. The revenues of the pension systems are denoted below, and the expenditures above the horizontal lines.

A. Exogenous contribution rate

(1) Fixed-fee system

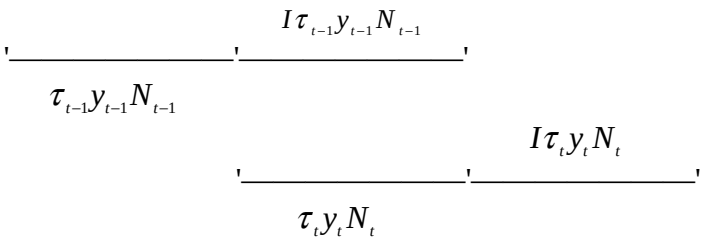
In this pension system, there is a *fixed* contribution rate τ_t in each period, though the rate may vary from period to period. Since the system is PAYGO, aggregate pension benefits in period t are determined by the revenues of the system in the same period, $\tau_t y_t N_t$. Hence, the budget is balanced by definition.

	(t-1)	(t)	(t+1)
Expenditures		$\tau_t y_t N_t$	
Revenues	$\tau_{t-1} y_{t-1} N_{t-1}$		
		$\tau_t y_t N_t$	$\tau_{t+1} y_{t+1} N_{t+1}$

Each pensioner in period t gets $\tau_t y_t N_t / R_t$ (1)
Implicit return factor: $\tau_t y_t N_t / \tau_{t-1} y_{t-1} R_t$. (2)
This factor is G_t if $R_t = N_{t-1}$ and $\tau_t = \tau_{t-1}$.

(2) Actuarially fair, fully funded system

As in the fixed-fee system, the contribution rate τ is exogenous in each period and the pension benefit is endogenous. The return on the individual's forced saving is equal to the return in capital markets, *i*. There is intertemporal budget balance for each cohort.

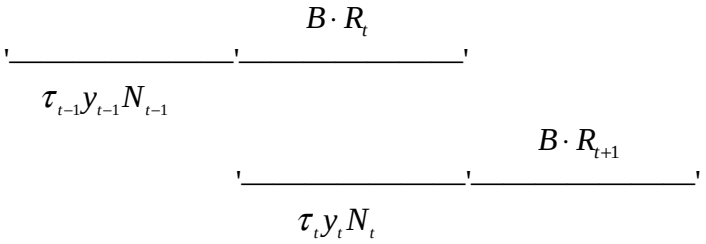


As is well known, a compulsory fully funded pension system will influence the consumption of the individual only if he is liquidity constrained or unwilling to borrow, and hence unable to offset government-induced reallocations of his cash flow over the life cycle.

B. Endogenous contribution rate

(3) Lump-sum benefit system

This pension system provides the individual with an exogenously given *basic pension*, while the contribution rate τ is endogenously determined in each period to ensure yearly balance in the budget of the pension system.



Balanced budget requirement: $BR_t = \tau_t y_t N_t$.

Implicit return factor[1]: $\left(B/y_{t-1}\right)/\tau_{t-1} = \tau_t y_t N_t / R_t \tau_{t-1} y_{t-1}$. (3)

[1] The return is the same as in the fixed-fee system, eq. (2), if the benefit is the same $\left(B = \tau_t y_t N_t / R_t\right)$.

This factor is G_t if $R_t = N_{t-1}$ and $\tau_t = \tau_{t-1}$.
B/y_{t-1} is the "replacement rate", which is inversely proportional to the individual's previous income.
Endogenous $\tau = (B/y_t) \cdot (R_t/N_t)$, (4)
where B/y_t = the " intergenerational income ratio" and R_t/N_t the "dependency ratio".

(4) Earnings-based system

In this system, the pension of an individual is determined as a fixed fraction (replacement rate) α of his previous earnings.

$$\frac{\alpha y_{t-1} R_t}{\tau_{t-1} y_{t-1} N_{t-1}} \qquad \frac{\alpha y_t R_{t+1}}{\tau_t y_t N_t}$$

Balanced budget requirement: $\alpha y_{t-1} R_t = \tau_t y_t N_t$.
Implicit return factor [2]: $\alpha y_{t-1} / \tau_{t-1} y_{t-1} = \alpha / \tau_{t-1}$ (5)
This factor is G_t if $R_t = N_{t-1}$ and $\tau_t = \tau_{t-1}$.
Endogenous $\tau_t = \alpha y_{t-1} R_t / y_t N_t$. (6)

(5) Contribution-based system

The pension in this system is a fixed fraction, γ, of contributions previously paid by the individual. Such a system is sometimes called a "notional defined contribution" (NDC) system.

$$\frac{\gamma \tau_{t-1} y_{t-1} R_t}{\tau_{t-1} y_{t-1} N_{t-1}} \qquad \frac{\gamma \tau \cdot w_t \cdot R_{t+1}}{\tau_t y_t N_t}$$

[2] The return is the same as in a lump-sum benefit system if $\alpha = B / y_{t-1}$.

Balanced budget requirement: $\gamma\tau_{t-1}y_{t-1}R_t = \tau_t y_t N_t$.
Implicit return factor: $\gamma = \tau_t y_t N_t / \tau_{t-1}y_{t-1}R_t$. (7)
This factor is G_t if $R_t = N_{t-1}$ and $\tau_t = \tau_{t-1}$.
Endogenous $\tau_t = \gamma\tau_{t-1}(y_{t-1}R_t / y_t N_t)$ (8)

(6) Fixed intergenerational income-ratio system

In this system, the pension of an individual is a fixed fraction, μ, of the average earnings of *contemporary* workers, i.e., the system is based on an intergenerational income distribution target.

$$\frac{\mu y_t R_t}{\tau_{t-1}y_{t-1}N_{t-1}} \qquad \frac{\mu y_{t+1}R_{t+1}}{\tau_t y_t N_t}$$

Budget balance requirement: $\mu y_t R_t = \tau_t y_t N_t$.
Implicit return factor: $\mu y_t / \tau_{t-1}y_{t-1}$. (9)
This factor is G_t if $R_t = N_{t-1}$ and $\tau_t = \tau_{t-1}$.
Endogenous $\tau_t = \mu \cdot R_t / N_t$. [3] (10)

To summarize, in a fixed-fee pay-go system, the (endogenous) pension benefit to a representative pensioner has to fall in proportion to a drop in average earnings of contemporary workers (y_t) and in the number of workers (N_t) relative to the number of pensioners (R_t); see eq. (1). In lump-sum benefit, earnings-based and contribution-based systems, the (endogenous) contribution rate has to be raised in proportion to similar changes in the same variables; see eqs. (4), (6) and (8). In a fixed income-ratio system, the (endogenous) contribution rate has to be raised in proportion to a fall in the number of workers relative to the number of retirees; see eq. (10). In actuarially fair systems, neither

[3] An alternative version of this pension system could be a fixed after-tax income ratio between generations, with the pension set to $\mu(1-\tau_t)y_t$. The implicit return factor is now $\mu(1-\tau_t)y_t/(\tau_{t-1}y_{t-1})$, but with a balanced

the contribution rate nor the pension benefit is *directly* related to the number of pensioners or aggregate earnings of workers.

Observe that the well known result that the rate of return in a pay-go pension system equals the growth rate of the wage sum (G_t) holds only if $\tau_t = \tau_{t-1}$ and $R_t = N_{t-1}$. The intuition is obvious. So long as the contribution rate is raised over time ($\tau_t > \tau_{t-1}$), the return for contemporary pensioners is higher than G_t; see equations above for the return factor. And if some individuals die before retirement age (so that $R_t < N_{t-1}$), those who live long enough to receive pensions will get a higher return G_t on previously paid contributions. [4]

To highlight the incentive structure for individuals in different pension systems, it is useful to write aggregate contributions as $\tau_{t-1} y_{t-1} N_{t-1} = \Sigma \tau_{t-1} w^j_{t-1} h^j_{t-1}$. Suppose that the individual increases the number of hours he works, h^j_{t-1}, or raises his wage, w^j_{t-1}, by his own effort (including training). Both his contributions and his pension benefits will then increase in the same proportion in a contribution-based system with individual (notional) accounts, i.e., a NDC system. I will call such a system "quasi-actuarial", since there is a close link between the contributions paid earlier by the individual and the benefit that he subsequently receives. (The term "quasi" refers to the fact that, in general, the return differs from the return in financial markets.) In fixed-fee, fixed income-ratio and lump-sum benefit systems, the individual pension depends only on *aggregate* contributions and earnings, not on the individual's own contributions or earnings. Thus, when the individual changes the number of hours he works h^j_{t-1} or influences his wage w^j_{t-1}, there is no effect whatsoever on the individual's own pension.

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budget the return will be identical to the case in the text: $\tau_t N_t y_t / (\tau_{t-1} R_t y_{t-1}) = G_t$ if $R_t = N_{t-1}$ and $\tau_t = \tau_{t-1}$. The endogenous τ_t required for a balanced budget is now $\mu(1-\tau_t) R_t/N_t$.

[4] Both pension systems with exogenous contribution rates (systems (1) and (2) above) and contribution-based system (system (5) above), with endogeneous contribution rates, could possibly be called DC systems. The remaining systems discussed above would then be called DB systems. But some authors reserve the term "DC system" for actuarially fair, fully funded systems with individual accounts, while a DB system is then identified as a system where pensions are tied to previous earnings (with lump-sum

The distinction between earnings-based and contribution-based systems is not brought out in the two-period framework above. To highlight this distinction, we have to partition the period of work into a number of sub-periods (at least two). In this case, only if the contribution rate τ is constant over time will the implicit return be the same in both systems (assuming the calibration $\alpha = \gamma\tau_{t-1}$.[5])

II. Effects of socioeconomic changes

Let us begin by looking at the effects of four types of socioeconomic change on the distribution of income between pensioners and workers, and hence the risk-sharing properties of different pension systems: (1) a reduction in the number of workers (N_t); (2) lower average labor income (y_t) or a slower rate of increase in labor income (y_t/y_{t-1}); (3) a greater number of retired individuals (R_t); and (4) lower interest rates (i).

I begin with the "direct impact" on the income of workers and pensioners, i.e., the *ceteris paribus* effect on income of a change in a socioeconomic variable, with given rules concerning benefits and fees, and with constant values for the other variables. Since the exposition is not based on a formal general equilibrium model, indirect effects, for instance on product prices, wages and asset prices, are treated heuristically.[6] A useful starting point then is to examine the consequences of various disturbances for the macroeconomic balance between aggregate demand and supply of output and financial assets. In this way, we are reminded of the fact that the macroeconomic costs of providing pensions for the elderly consist of their increased consumption, which reduces resources available for younger generations.

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pensions regarded as a special case). The latter terminology is used, for instance, by Diamond (2000) and Thomson (1998).

[5] Assume that the individual works in two periods and is retired in a third period. Retired individuals are then supported by two subsequent generations -- one engaged in its second period of work and the other in its first period of work. Earnings of workers in periods t-2, t-1, and t are y_{t-2}, y_{t-1}, and y_t, respectively. The oldest generation, which starts work in the period t-2, consists of N_{t-2} workers, and the two subsequent generations which start work in periods t-1 and t, respectively, consists of N_{t-1} and N_t workers. In an earnings-based system, the implicit return factor is now $\alpha(y_{t-2} + y_{t-1}) / (\tau_{t-2}y_{t-2} + \tau_{t-1}y_{t-1})$, while in a contribution-based system it is γ. If $\tau_{t-2} = \tau_{t-1} = \tau_t$, the return is the same in both systems if $\alpha = \gamma\tau_{t-1}$. The same condition assures that the endogenous contribution rate is the same in both systems.

[6] For formal general equilibrium analysis of pension systems, see Diamond (1977) and Bohn (1999).

Reduced number of workers

An actual or expected fall in the number of workers (reduced N_t) for a prolonged period is one important factor behind recent concerns about the viability of existing pensions systems. On a high level of abstraction, the consequences are rather similar regardless of whether such a decline is the result of emigration or a fall in the birth rate (in the past).

Under fixed-fee pension systems, pensioners have to bear the entire (direct) burden of adjusting to such a change because the aggregate amount of pension benefits is constrained by the exogenously given contribution rate *times* the tax base. Disposable income of individual workers is unaffected. The benefit received by the average pensioner, $(\tau_t y_t N_t)/R_t$, and the implicit rate of return on previous contributions, $(N_t/R_t)(y_t/y_{t-1})$, are both reduced in proportion to the fall in N_t. It is therefore reasonable to assume that the aggregate consumption of pensioners will fall in (about) the same proportion. Since there is no reason why individual workers would change their consumption, the aggregate consumption of workers would also be expected to fall in that proportion. If aggregate output happens to decrease by the same percent as employment, there would be no disturbance to the macroeconomic balance.

In all of the other pay-go systems mentioned above, workers have to bear the entire (direct) burden of adjustment since fewer workers have to finance the same (fixed or predetermined) aggregate pension payments as before. Neglecting conceivable consequences for aggregate labor supply (i.e., assuming the income and substitution effects on labor supply approximately cancel), τ_t has to be raised in proportion to the fall in the number of active individuals in order to balance the pension budget; see eqs. (4), (6), (8) and (10).[7] Workers' *aggregate* consumption tends to decrease as a result of both the fall in the number of workers and the reduction in after-tax income of each individual worker. Thus, if aggregate output (again) happens to decline in proportion to the reduction in the number of workers, then aggregate demand is likely to fall more than

[7] The derivative of ln τ_t with respect to ln N_t is minus one.

aggregate supply. If so, there will be macroeconomic scope for reduced taxes and/or increased government spending.

Clearly, there is no (direct) risk sharing in any of the pay-go systems listed above in response to a fall in the number of workers.

The consequences for various pension systems are about the same if employment falls as a result of increased structural unemployment. In this case, however, the government would be in a worse financial position due to higher expenditures for unemployment benefits. It is also worth noting that a rise in structural unemployment may to some extent be caused by the pension system itself because payroll taxes tend to raise labor costs for workers that are exposed to minimum wages (via legislation or collective bargaining).

In the context of an actuarially fair (fully funded) pension system, by contrast, the income of both individual pensioners and individual workers will be unaffected. After a fall in N_t, both have sufficient income to continue consuming as much as before – as long as indirect effects are neglected. But there may be indirect effects. When pensioners start unloading financial assets, there are fewer potential buyers of these assets (than before) due to the fall in the cohort size of workers. As a result, asset prices would fall and interest rates rise – except in the special case of a small open economy with capital markets that are completely integrated internationally. [8] By this indirect route, pensioners may suffer from a fall in the number of workers also under an actuarially fair pension system. This argument assumes, of course, that asset holders do not rationally (fully) anticipate future changes in the demand for and supply of assets in connection with future demographic change. Moreover, since workers may also hold financial assets, some risk sharing with workers will take place via this indirect route , i. e., via falling asset prices.

Except for the case of a very large decline in asset prices when pensioners unload their securities, aggregate demand is likely to fall less than aggregate output in a society with

[8] If the same demographic change occurs simultaneously in other countries, pensioners would also be exposed to lower assets prices in small open economies with fully integrated international capital markets.

an actuarially fair, funded pension system. If so, there would be domestic excess demand for goods and services, with increased inflation or deterioration of the current account of the balance of payments, or both. If pensions are not fully indexed to inflation, which they usually are not in fully funded systems, retirees will have to accept further downward adjustment of their per capita consumption. Pensioners may also be harmed by government attempts to combat the current account deficit with policy measures designed to reduce domestic aggregate demand. After all, the size of the current account of the balance of payment is often a policy target of the government – for good or bad reasons.

Determining the proportion of the reduction in consumption of workers and pensioners would require a quantitative general equilibrium model, which is outside the scope of this paper. In any event, a main point here is that even under an actuarially fair pension system, pensions may not be fully protected against the consequences of a drop in the number of workers – due to the eventuality of falling asset prices, a deterioration in the current account of the balance of payments and (without price indexation of asset return) higher inflation.[9]

B. Reduced labor-income growth

The slowdown in the rate of growth of average labor income (a fall in y_t/y_{t-1}) since the early 1970s is another factor underlying today's concern about pension systems. This development might not be entirely regarded as an exogenous shock from the point of view of the pension system. To some extent, the slowdown may have been induced by labor market distortions due to marginal tax wedges associated with payroll taxes – resulting in negative substitution effects on both hours of work h^j and real wages w^j (the latter because of disincentives on investment in human capital and on work intensity).

In the context of a pay-go pension system, the direct distributional effects are rather similar to the case of a fall in the number of workers; *y* and *N* enter in the same way in most pay-go systems. One important difference, though, is that *individual* workers are now directly exposed to reduced earnings. This holds regardless of whether the fall in

[9] Such mechanisms are discussed in Barr (1999).

earnings is the result of lower wages, w^j, or shorter hours of work, h^j (for instance, via "work sharing").

Both a fixed-fee system and a fixed income-ratio system incorporate (automatic) risk-sharing devices between workers and pensioners in the case of shocks in wages and hours of work, as opposed to the earlier discussed case of a change in the number of workers.[10] In fixed-fee systems, a fall in workers' average disposable income by $\Delta y\,(1-\tau_t)$ is accompanied by a fall in the average pension by $\tau_t \Delta y(N_t/R_t)$. Thus, income risk is shared between pensioners and workers in the proportion $[\tau_t/(1-\tau_t)]\cdot(N_t/R_t)$. In the case of a fixed income-ratio system, a fall in average labor income is shared between representative agents in the two groups in the proportion μ. The consequences for macroeconomic balance are quite complex and depend partly on whether the fall in the real wage is related to a drop in productivity and hence output, and/or to a redistribution of income between labor and capital.

Again, the consequences are more complicated in an actuarially fair system. Since there is no direct impact on pensioners, individual workers have to bear the entire direct burden of a fall in real wages. Meanwhile, the reduction in wage rates implies that workers have fewer resources available to buy unloaded assets from pensioners. So asset prices may decline in this case as well, thereby reducing pensioners' resources for consumption – with the earlier reservation in the case of a small open economy with perfect capital mobility, or with rational expectations. If so, some of the wage risk for workers is translated into asset risk for pensioners. As in the case of pay-go systems, it is a complicated matter to determine the consequences for macroeconomic balance and inflation.

The slowdown in real-wage growth from the mid-1970s in most developed countries may very well be reversed in the future, for instance, as a consequence of the emerging ICT revolution. This would strengthen the financial viability of existing pa-go pensions

[10] Robert C. Merton (1983) pioneered in showing that pay-go pension systems may pool labor and capital income risks between the young and the old.

systems. But then the ratio between pensions and the wages of coexistent workers would fall in the context of lump-sum benefit, earnings-based, contribution-based and actuarially fair pension systems – with the possibility of distributional conflicts as a result.

C. Increased number of pensioners

Recent and predicted future increases in the number of retirees is a third important factor behind today's concern about pension systems. The consequences depend on how this change comes about – for instance, via immigration of elderly people, the aging of a particularly large cohort ("baby boomers"), early retirement, or higher longevity after retirement.

In the first case – immigration of elderly individuals – the crucial issue is how immigrants are treated relative to native-born citizens.[11] The consequences are more clear-cut if the number of retired individuals increases as the result of aging of a particularly large cohort, which may be described as a parallel increase in N_{t-1} and R_t with N_t unchanged. In fixed-fee systems, per capita pensions will fall in proportion to the rise in R_t, (eq. (1)), while contribution rates would have to be raised in the same proportion in lump-sum benefit, earning-based, contribution-based and fixed income-ratio systems (eqs. (4), (6), (8)). Again, there is no automatic risk-sharing mechanism. Assuming no differences in marginal propensities to consume, problems of macroeconomic balance would not be induced (except for labor supply effects of higher marginal tax rates).

[11] If they are treated in the same way, immigrants would be entitled to a domestic pension under three of the generic pension schemes listed: fixed-fee, lump-sum benefit and fixed income-ratio systems. In fixed-fee systems, "domestic" pensioners would have to accept a fall in their per capita pension by the factor N_{t-1} / R_t, while in lump-sum benefit and fixed intertemporal income-ratio pension systems, payroll taxes would have to be raised by that factor. Thus, there are no automatic mechanisms for risk sharing between workers and pensioners in any of these systems when the number of pensioners increases via immigration of elderly people. Problems of macroeconomic balance will not arise as long as the marginal propensity to consume is the same for all groups concerned. Income flows in the context of other pension systems – earnings-based, contribution-based and actuarially fair systems – would be unaffected. Under these three systems, elderly immigrants will (in the real world) be financed by relatives or by social welfare payments. The latter, of course, would require a general tax increase.

If a rise in the number of pensioners is instead caused by an increase in the frequency of early retirement, the outcome would be a simultaneous rise in R_t and a fall in N_t. In reality, this type of change is often induced by the incentive structure of the pension system itself including generous rules for early retirement. In the context of a fixed-fee system, pensions would have to be reduced in proportion to the fall in the ratio N_t/R_t , while in lump-sum benefit, earnings-based, contribution-based and fixed intergenerational income-ratio systems, the tax rate would have to be raised in proportion to the rise in the ratio R_t /N_t.

In the context of an actuarially fair pension system, there will be no direct impact on the income flows. But when a large number of pensioners sell assets to workers, the former may face falling asset prices in the same way as in the case of a reduced number of workers. This would imply that pensioners will be hit indirectly in fully funded systems as well – except with fully rational expectations or in a small open economy with fully internationalized capital markets.

The situation becomes more complicated if the number of pensioners instead increases because of greater longevity after retirement, so that R_t increases relative to both N_{t-1} and N_t. In fixed-fee systems, pensioners would have to accept a reduction in yearly pensions in proportion to higher longevity. More precisely, there will be a reduction in yearly pensions by the change in the factor N_{t-1} / R_t . By contrast, under lump-sum benefit, earnings-based, contribution-based and fixed intergenerational income-ratio systems, τ_t would have to be raised in proportion to the increase in the ratio R_t/N_t, provided each pensioner is guaranteed the same annual pension as before. Again, there is no risk sharing between generations.

In principle, the situation is the same in the case of an actuarially fair system as in a fixed-fee system, if information about longevity is obtained exactly when a fixed annuity is determined (at the time of retirement); the annuity has to be reduced in proportion to greater longevity. However, if such information is not obtained until *after* the annuity has been determined, the pension provider has to cover the higher costs, while the annual

income of pensioners is unchanged. But in reality, information about higher (expected) longevity is usually available *before* retirement, during the course of working life. The insurance provider is then able to propose higher contributions, and workers are likely to accept such proposals. It has been argued that similar adjustments are difficult to achieve under pay-go systems, because the link between what an individual pays and what he receives later on is usually rather weak. Since the fee in such a system functions as a tax wedge, higher fees may also be resisted by those who are anxious to avoid additional work distortions (Persson, 1998).

D. Lower real interest rates

The rise in real interest rates in recent decades, as compared to the 1950s and 1960s, is an important factor behind the increased popularity of actuarially fair, fully funded systems. Since I have already discussed shocks that create problems mainly for PAYGO systems, I now examine an interest shock that creates problems for actuarially fair, fully funded systems, i.e., a fall in real interest rates. A fall that takes place after retirement will *either* create financial difficulties for the pension provider (if the annuity is fixed) *or* force retirees to accept lower pensions (if the annuity is variable in the sense that it is gradually adjusted to realized asset returns also after retirement). In the first case, pension providers may try to shift the consequences of interest-rate shock onto subsequent cohorts of pensioners.

At the level of an individual pensioner, an obvious difference between a fixed and a variable annuity is that in the latter case he has to accept higher income risk during the period of retirement. The reason, of course, is that with a variable annuity, the drawing down of previously accumulated pension capital takes place only gradually during the retirement period. The advantage to the individual is that he then has a further opportunity to enjoy the return on assets, such as shares, after having retired. A variable annuity also fulfills the role of reducing fluctuations in the *relation* (ratio) between replacement rates for consecutive cohorts of pensioners. The reason here is that the capital value of the annuity will not depend so much on the situation that happens to prevail on financial markets at the time of retirement. This gives rise to a genuine trade-

off problem. While a fixed annuity provides greater income insurance in connection with uncertainty about longevity, a variable annuity furnishes relative income insurance in connection with uncertainty about asset prices at the time of retirement. The individual may alternatively opt for "revolving" annuitization for a number of years before retirement, or a gradual shift (also before retirement) to less risky assets. But this means that the individual would miss out on the opportunity to enjoy the return on high-yielding assets after retirement on the basis of accumulated pension capital.

So far I have only considered changes in real interest rates at or after retirement. If real interest rates have already fallen during the individual's working life, and are expected to remain low for quite a while, he would probably agree to pay higher yearly contributions to a fully funded system in order to boost his future pension.

Even though there are no direct effects (as long as there are no buffer funds), pay-go pension systems are not immune to changes in real interest rates. Both contribution rates and pension benefits may be influenced indirectly (general equilibrium effects). The most obvious indirect effect is that lower (higher) real interest rates would increase (reduce) future real wage rates via a boost (retardation) of the real capital stock. But it is also important to consider changes in factor prices that are induced by the pension system itself, an issue to be dealt with in subsequent sections.

III. Marginal reforms

A. Ad hoc adjustment

Under all of the stylized pension systems discussed above, well-specified rules guarantee budget balance – intertemporal balance in fully funded systems and yearly balance in pay-go systems, in the latter case via adjustments in either fees or pensions. In reality, however, adjustments in conformity with such rules often require explicit political decisions in the case of pay-go systems. As a result, such adjustment may take considerable time, partly because of conflicts about the distribution of income. In the meantime, financial imbalances of a pay-go pension system easily emerge after

exogenous shocks. All this is likely to initiate demand for *ad hoc* changes in contributions and/or benefits, i.e. changes outside the original rule system. In extreme cases, a pay-go pension system may even break down, in the sense that large and rising deficits finally necessitates abrupt, unplanned cancellations of earlier promised entitlements.

For example, after a fall in the number of workers (N) or in average real earnings (y), workers may resist higher fees in lump-sum benefit, earnings-based and contribution-based systems and in fixed income-ratio systems after a fall in the number of workers. It is therefore tempting to speculate that workers may want to force contemporary pensioners to share the burden of adjustment in such cases. Indeed, doubts are often expressed in the political debate as to whether a majority of voters will grant promised pension entitlements to the elderly after such disturbances. If explicit changes in the rules for pension benefits (B, α, γ or μ above) are not politically feasible, obvious alternatives are higher taxes on pension income or partial punctuation of price indexation of pensions –illustrations of the role of "framing" in politics.

Since pensioners constitute only a minority among voters, it is perhaps less likely that workers could be forced to share the burden of adjustment (via an increase in τ) when the burden would otherwise fall on pensioners. (This occurs, for example, in the case of a fall in the number of workers in fixed-fee systems and in the case of reduced real interest rates in actuarially fair systems, unless a fixed annuity has been set.) Policy actions for this purpose may be released, however, if pensioners are an important swing group in the political arena, and if their voting behavior is particularly sensitive to the pension benefits offered. Pensioners may also find political support for their position among workers close to retirement.

Even though the benefits of contemporary pensioners have recently been cut to a considerable extent in some countries, and fees have been raised for workers, empirical evidence suggests that political authorities have mainly opted for a "third alternative": cuts in pensions for *future* pensioners (McHale, 1999). As an explanation, John McHale has hypothesized that today's workers are afraid of becoming exposed to even greater

cuts in their own pensions in the future unless they agree to some cuts immediately. But another explanation could be that the political price is higher if the government cuts current disposable income by means of higher fees or lower pensions today, than if it decides to reduce pensions *far ahead into the future*. After all, myopic behavior is not unheard of; indeed, reference to such behavior (often interpreted as time inconsistency) is one of the most common arguments for having compulsory pension systems in the first place.

When a pension system encounters problems because of a fall in the number of individuals of working age relative to the number of individuals above retirement age (the ratio N_t / R_t), immigration of young workers may be a solution. This presupposes, of course, that such immigration is not expected to result in serious tensions and conflicts in society.

B. Automatic adjustment mechanisms

To introduce new types of automatic adjustment mechanisms within existing pension systems is an alternative to *ad hoc* policy interventions for dealing with the distributional consequences of exogenous socioeconomic shocks. One way of achieving this consists of shifting to a "fixed income-ratio" system (system no. 6 in the classification above). However, such a reform cannot be combined with ambitions to maintain strong quasi-actuarial elements in the pension system, which exist in contribution-based systems with individual accounts (system no. 5 in the classification above). But it would still be possible to make *relative* pensions among individual pensioners proportional to each individual's accumulated earnings or contributions; thus, some *relative* quasi-actuarial element could still be achieved.

We may also want to modify redistributions of income among generations in the case of unexpected increases in longevity after retirement. Under lump-sum benefit, earnings-based and contribution-based systems (i. e., pension systems of types 3-5 in the classification above), a technically simple way of avoiding that wage earners have to bear the entire burden of adjustment is an automatic rule that makes annual pensions a

declining function of remaining life expectancy after retirement. For example, when pension annuities in the new NDC-pension system in Sweden are determined, pension benefit will be inversely proportional to expected longevity after retirement. However, this means the entire burden of adjustment will be borne by the retirees – hardly a risk-sharing device, which has made Peter Diamond (2000) question the wisdom of this element in the Swedish pension reform.[12]

A higher retirement age – the ordinary age as well as the lowest early retirement age – is a particularly natural response if the number of retirees rise as a result of improved health of individuals above today's retirement age. In terms of the notations above, the budget balance of the pension system then would be improved by a combination of higher N_t and lower R_t. (It may then also be important to implement stricter rules for disability and unemployment insurance, since these systems in fact have been used as alternative routes to early retirement also for individuals without serious health problems).[13] Increased downward flexibility of relative wages for the elderly, e.g. a less steep age-wage profile, is one way of avoiding that a large fraction of the elderly would wind up in unemployment if the retirement age were raised considerably is. An alternative would be to reduce payroll taxes for the elderly. In most countries, union and government wage policies may be obstacles to both these solutions.

Since both health and preferences for work vary considerably among the elderly, there is no doubt also a strong case for a *flexible* retirement age. But to avoid distorting work incentives, and to keep pension systems financially viable, there is also good arguments for combining such flexibility with actuarially fair adjustments of pensions under conditions of early retirement. Elderly individuals with health problems could then be referred to the sick insurance system. It is curious that today's pension systems and labor market arrangements are designed in ways that appear to turn higher longevity and better

[12] The new pension system in Sweden, however, does not include any automatic adjustment mechanisms if remaining life expectancy of individuals of a given age rise during their retirement period. Such costs have to be covered by *ad hoc* adjustments via the "brakes mechanism" mentioned in the text.

[13] There are limits, of course, to what can be achieved by such a reform. Given current fees and benefit rules, the OECD has calculated that the statutory retirement age would have to be raised, within a few

health among the elderly into serious *social problems*, rather than a blessing. This design is hardly an example of good "social engineering".

A more crude way of making a pension system financially viable via automatic adjustment mechanisms, regardless of the type of disturbance, would be automatic reductions in benefits and/or increases in fees in response to an emerging or anticipated deficit in the pension budget.

IV. Radical Reforms

A. Shifting to a quasi-actuarial system (NDC system)

Lump-sum benefit systems and earnings-based systems (pension systems of types 3 and 4) have served as the most common pension schemes during the second half of the 20th century. While the former are completely non-actuarial, there is some indirectly positive link between the individual's earlier contributions and his pension in earnings-based systems. But the link is very weak in most countries since pensions are often calculated on the basis of earnings during a limited number of years of work. It is not *technically* difficult to strengthen the link between benefits and previously paid contributions – also without pre-funding. One obvious technique would be to increase the number of earning years used as a basis for the size of an individual's pensions.

The most straightforward way, however, would be to shift to a "notional defined contribution systems" (a NDC system) with individual accounts (a pension system of type 5 with the average *and* marginal return $\gamma = G_t$ for the individual when $R_t = N_{t-1}$ and $\tau_t = \tau_{t-1}$). James Buchanan (1968) may have made the first proposal along these lines. A basic argument for this reform involves reducing the implicit marginal tax wedge on work, hence raising the return on work. Since economic efficiency will then increase in the labor market, a Pareto improvement is possible in principle. There would also be less risk of undermining the financial viability of the pension system via an induced reduction

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decades, to no less than 73-74 years in many developed countries to keep pension systems financially viable. See Thomson (1998), p. 48, fn. 10) and OECD (1988).

in the number of employed workers (N) or a reduction in earnings per worker (y) due to a fall in hours of work or labor productivity. Under realistic assumptions, about 40 percent of the tax wedge implicit in the pension system may be removed by a shift from a completely non-actuarial to a quasi-actuarial, contribution-based pension system with individual accounts.[14]. A prerequisite for favorable effects on work incentives, of course, is that an individual understands the connection between his own contributions (payroll taxes) and his subsequent pension benefits.

It is virtually impossible, however, to create a *fully actuarially fair* pay-go system, i. e., a system without tax wedges, in a dynamically efficient economy, i.e., an economy in which the real interest rate is higher than the growth rate. If a pay-go pension system would pay a higher return than the growth rate of the tax base, the system would wind up with an ever rising deficit. In other words, an actuarially fair pay-go pension system is not financially viable in a dynamically efficient economy. In a dynamically inefficient economy, by contrast, it can be shown that an actuarially fair pay-go system would automatically accumulate a fund of the same size as in a fully funded system (Hassler and Lindbeck, 1997). But then there is no point in choosing an actuarially fair system in the first place since the return on paid contributions would be higher in a traditional pay-go system, where it is equal to the growth rate of aggregate earnings.

But is it possible, or even desirable to make a pay-go system actuarially fair *just on the margin*, while maintaining budget balance by setting the average return equal to the growth rate of the economy? Intuition suggests that efficiency would be improved if the

[14] Assume that an individual starts working at the age of 20, retires at 64 and lives for another twenty years thereafter. On average, a worker pays his contribution at age 42, and he receives his pension at age 74. Thus, as an approximation we may say that 32 years (74-42) elapses between the payment of the contribution and the enjoyment of the benefit. Let the contribution rate (τ) be 20 percent, so that if an individual earns \$500 more (due to more hours of work or higher work intensity) he pays \$100 as pension contributions. In a quasi-actuarial pay-go system in which the return is 2 percent (the growth of the tax base), this contribution will be worth \$188 after 32 years. If the real rate of return in financial markets is 5 percent and this is used as a discount rate, the capital value of these \$188 at average working age is \$40 ($188/(1.05)^{32}$). This means that the marginal tax wedge on work is 12 per cent (100-40)/500). Thus, a shift from a completely non-actuarial to a quasi-actuarial system will reduce the tax wedge from 20 percent to 12 percent in this case. The marginal tax wedge would be zero if the forced pension saving had instead been invested in a fund earning 5 percent per year (assuming that the funded system is started from scratch). See Lindbeck and Persson (2000), p.7.

marginal return on pensions were set in such a way that the individual's marginal work decisions are indifferent between paying pension fees and investing on the capital market. The point would be that many economic distortions are associated with marginal rather than average tax wedges. It turns out to be *technically* possible to create such a system (Auerbach and Kotlikoff, 1987; Hassler and Lindbeck, 1997) Owing to intragenerational distributional considerations, however, such a system is politically difficult to implement, since it requires a lump-sum tax (a "poll tax") in order to balance the pension budget.[15]

The financial viability of a pay-go pension systems, of course, requires that pensions are tied to the growth rate of *aggregate* earnings, hence the product $y_t N_t$, rather than to the growth rate of *average* earnings y_t. When the new pension reform in Sweden in the late 1990s promised a rate of return on paid contributions equal to the rate of growth of average wage earnings, the system threatens to be unstable in the case of slow employment growth. It was therefore necessary to introduce a "brake mechanisms" on pension benefits, a mechanism that will be automatically released in the case of slower employment growth.

B. Shifting to an actuarially fair, fully funded system

I have pointed out the efficiency gain of shifting from a pay-go pension system with a weak (or non-existing) link between contributions and benefits for the individual to a pay-go system with a stronger link, for instance a quasi-actuarial system with individual accounts (system 5 in the classification above). A similar efficiency gain may, of course, be achieved by a shift to a fully funded pension system (system 2 above), since the marginal tax wedge falls in this case as well.

But what then is the gain, if any, of a shift from a quasi-actuarial pension system (with a strong link between contributions and benefits) to a fully funded system with a market rate of return? Neglecting, to begin with, conceivable behavior adjustments of individual, it is easy to show that the capital value of the gross income gain for individuals

[15] Moreover, for a given tax rate, τ, it can be shown that the welfare gain of the increased efficiency of work would wind up entirely with the older generation. If the objective is to let all generations enjoy a welfare

participating in the pension system is the same as the implicit debt to the pay-go pensioners. Thus, there is no *aggregate* income gain of such a shift since somebody has to serve this implicit debt (Feldstein, 1995**;** Sinn, 1999). Starting out with a quasi-actuarial pension system, a shift to a fully funded system will *not* result in a Pareto improvement in the labor market – assuming no distortion of the capital stock to begin with (Kotlikoff, 1998, Fenge, 1995; Lindbeck and Persson, 2000). This conclusion assumes that all income streams are discounted by the market interest rate (which is not completely self-evident, since we compare incomes of different generations rather than incomes during different periods for a given individual).

There will, of course, be redistributions among generations. The sign and size of these redistributions depend crucially on how the claims of the old pay-go pensioners are met. If the pay-go pensioners are bailed out by taxes on a "transition generation", this generation will experience a sizeable income loss, while subsequent generations will experience income gains – as compared to the alternative of retaining the pay-go system. Our attitudes to such redistributions among generations, of course, depend on how we evaluate (i.e., discount) income of different generations. One argument for enforcing a redistribution to future generations may be that the previous introduction of the pay-go pension system, most likely, reduced aggregate saving and hence the aggregate capital stock, to the disadvantage of future generations. Metaphorically speaking, since the grandparents of today's children originally received a gift at the expensive of future generations, the grandchildren may ask their parents' generation to contribute to an increase in the capital stock via compulsory pension saving. Since lump-sum taxes hardly are politically feasible, a transition generation would also be exposed to higher *marginal* taxes, with lower economic efficiency of work as result. Subsequent generations would instead be able to enjoy smaller marginal tax wedges, with increased work efficiency as a consequence.

All this may give the impression that the issue of shifting from a quasi-actuarial pay-go system to an actuarially fair, fully funded pension system is only a problem of

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gain, the pension fee may be reduced, however (Hassler and Lindbeck, 1997).

intergenerational distribution of income (wealth), and a trade-off between work incentives and aggregate saving among different generations. There is more to it than this, however.

First, in most countries, existing capital-income taxation distorts aggregate national saving and investment. This is another reason – distinct from the previous one that the gift to the first generation of pay-go pensioners has reduced aggregate saving – why the capital stock is likely to be lower than it would have been otherwise. As a result, the *intertemporal* (subjective) discount rate may be lower than the return on capital assets, a point made by Martin Feldstein (1996). A shift to a fully funded pensions system, like a reduction in government debt, could then be regarded as a second-best policy designed to increase the distorted stock of aggregate wealth, including real capital assets, in society.[16]

Second, we also have to look at the risk-return combination of alternative pension systems. Normally, the returns on pay-go pension claims are not fully correlated with the return on claims in an actuarially fair pension systems. First, the growth rate of the tax base of a pay-go system (i.e., aggregate earnings) and the return on financial markets are not fully correlated, in particular not when pension funds hold foreign assets. The political risk is also likely to differ. For instance, claims on funded systems with individual accounts probably provide stronger property rights than do pension claims in pay-go systems. What all this boils down to is that a combination of a pay-go and a fully funded system provides a richer portfolio of "pension assets" than either of these pension systems in isolation. This is an additional rationale for a *partial* shift to a fully funded system.

The most problematic aspect of a (partial or total) shift to a compulsory, fully funded pension system is, in my view, how to minimize the risks that such a reform will – sooner or later – result in *politicization* of the domestic economy. There is a serious risk that future politicians will use government-controlled pension funds to allocate financial

[16] However, in some countries, including a number of European countries, this negative effect on the aggregate capital stock may have been compensated for by various types of investment subsidies, though these mahy have distorted the allocation of investment.

funds to “politically correct” industries and to those parts of the national economy where it is particularly tempting to buy votes. Politicians, or their subordinates, might also start using voting rights in firms to exert influence *within* firms, even though they may lack knowledge as to how firms should be run. Thus, the case against nationalization of pension capital is the same as the arguments against the Lange-Lerner proposal of market socialism.

Technically, it is possible to design institutions that isolate government-operated pension funds from political pressure, including party politics. The most obvious method is perhaps to require such funds to invest only in index funds, possibly global ones, and to give the managers of the funds instructions to exercise the voting rights in firms. But future politicians anxious to exercise economic power are free to change such rules. It is much easier politically to change the rules of portfolio allocation and corporate governance in existing government-operated funds than to propose outright nationalization of an economy “from scratch”. Thus, those who are critical of market socialism have good reasons to be critical also of government-operated pension funds. After all, proposals of market socialism also incorporated stringent (but unrealistic) rules instructing managers of government-owned firms to behave like profit miximizers under perfect competition.

The most promising way of mitigating the risks for politicization of the national economy is probably to make pension funds privately owned and operated from the outset, and to allow individuals to choose fund managers. The higher administrative costs of decentralized as opposed to centralized fund management is a price we have to pay for limiting the risk of politicization of the national economy. There are also devices to limit these administrative costs, such as caps on fees, which would induce some fund managers to choose index funds.

V. Adjustment to increased heterogeneity

Real-world pension systems have always, at least to some extent, granted (or exploited) the heterogeneity of the population. An obvious example is the overcompensation of early cohorts when pay-go systems were introduced – to bring about a rapid increase in the living standard of the elderly and/or to create broad political support for the reform. In particular, this overcompensation was brought about by a gradual increase in the contribution rate (a rise in the ratio τ_t / τ_{t-1}).

An example of overcompensation *within* cohorts is redistributions in favor of low-income groups via a basic (lump-sum) pension or a guaranteed pension with means-tests on pension benefits. In most earnings-based pension systems in the real world (when fixed annuities are tied to earnings during a limited number of years of work), females are also favored because of fewer years of work and a larger number of years after retirement. But there are also well-known regressive redistributional elements in most real-world pension systems, although it is difficult to say whether these effects are intentional or not. One example is redistributions in favor of individuals with a steep income profile over their life cycle (when the pension level is tied to earnings late in the individual's working life). Another example is redistributions to individuals with high expected longevity (in systems with fixed annuities). In both cases, the arrangements tend to favor highly educated individuals with relatively high lifetime income (wealth).

In recent decades, it is only natural that new types of heterogeneity in the population have given rise to proposals for pension reforms. An obvious example is increased instability of family structure. Pension systems established in the early 20th century were careful to provide support for widows and their children, since death of the (usually male) income provider used to be a dominating factor behind the breakup of families. The strong trend toward labor-force participation of married women has reduced the need for special pension claims for widows. It does not seem reasonable that widows should receive pensions based on both their own previous income (or contributions) and widowhood. A delicate issue, however, is what should be regarded a reasonable length of time to phase

out the latter type of pension claim. The huge increase in part-time work, also largely a result of increased labor force participation of women, also raises the issue of whether the benefit rules in contribution based and earnings based system should favor or disfavor part-time work of different length.

Today, family instability is largely related to divorce and temporary cohabitation outside marriage. One way of adjusting pension systems to this new situation would be to give couples property rights to each other's pension capital, in the same way as the law stipulates such property rights for spouses regarding real estate and financial assets. After all, pension capital usually accumulates gradually over the working life of families, in a similar way as other assets. A delicate issue here concerns how other forms of cohabitation than marriage should be treated.

The heterogeneity of the population has also increased as a result of changes in the traditional life cycle, characterized by the linear sequence of education–work–retirement. This sequence is currently being replaced by more complex and individually varied life cycles. The continuity of working life is often interrupted by education, retraining, periods of work in the home (for example, caring for children) and prolonged periods of leisure. This is an important background for contemporary proposals to replace existing welfare-state arrangements with compulsory saving accounts (possibly negative accounts early in life) and related drawing rights on claims accumulated before retirement.[17] Proposals of compulsory saving with drawing rights are based on the assumption that individuals can handle modest economic setbacks on their own by drawing on accumulated compulsory saving – for instance in connection with short periods of unemployment or health problems. However, people would be obligated to reserve a certain minimum balance in their accounts for old age. Thus, proposals of this type may be seen as efforts to encourage individuals to take greater responsibility for their own income protection in the event of moderate strain on their economic situation. Of course, when having to deal with major income losses, the system of drawing rights has to be

[17] An early proposal along these lines is Rehn (1961). More elaborate plans have been developed by Fölster (1999) and Orzag and Snower (1999).

combined with insurance; this point is also granted in most proposals. Another basic idea behind the scheme of drawing rights is to provide the individual with increased resources to shift between work, education and leisure over the life cycle. Work incentives would then also be improved (via smaller tax wedges) and problems of moral hazard mitigated – two major problems of today's social insurance systems (evidenced by moral hazard in the connection with unemployment, sick leave and early retirement insurances).

It is also a commonplace that higher international mobility of labor creates difficulties in "assigning" individuals to national pension systems. It will certainly become necessary to adjust pension rules in the future to deal with this issue and, in particular, to decide whether pensions should be provided on the basis of an individual's country of origin or country of residence. Without some coordination of national rules, individuals may in some cases lose entitlements earned in one country, while in other instances they may end up with more favorable pensions by living part of their lives in one country and part in another country. In the first case, the pension system would impede international mobility of labor in the same way as non-transferable occupational pensions among firms or sectors reduce domestic labor mobility. In the second case, international labor mobility may, in fact, be subsidized. Shifts to quasi-actuarial or to fully actuarial systems, or to compulsory saving with individual accounts would mitigate, or even eliminate, such problems. Of course, ambitions to use pension systems as tools of redistribution would then be reduced. Increased international flexibility of the choice of residence of individuals also creates an increased need to unify the taxation principles for *private* pension policies including occupational pensions. In some countries, such insurance contributions are deductible for tax purposes while subsequent pension benefits are taxed, whereas governments in other countries do just the opposite, which clearly distort residence decisions.

VI. Concluding remarks

As we have seen, the consequences for pension systems of various types of socioeconomic changes depend crucially on the detailed ("fine") structure of the pension system.[18] For instance, there is no (direct) risk sharing in pay-go pension systems in response to variations in the number of workers or the number of pensioners. By contrast, both a fixed-fee and a fixed income-ratio system incorporate automatic risk-sharing devices between workers and pensioners in the event of shocks in wages and hours of work. While there is no direct risk sharing in the case of socioeconomic shocks in fully funded systems, I have argued that indirect effects of different types may create some risk sharing.

It is clear that several weaknesses of current pay-go systems can be solved within the framework of existing systems. For instance, problems concerning financial vulnerability and unexpected redistribution may be mitigated by *ad hoc* increases in fees, cuts in benefits (often by way of less favorable price indexation) or increased retirement age. At the same time, such interventions highlight the political risks inherent in government-operated pension systems.

If more *automatic* risk sharing between generations is desired, an obvious reform is to shift to what has here been called fixed income-ratio systems, where the relation between pensions and the earnings of contemporary workers is fixed. The consequences of increased instability of the family can also be alleviated, for instance, by legislation requiring spouses to share each other's pension claims. If enhanced work incentives were called for instead, then the actuarial elements of the pay-go system could be extended by strengthening the link between contributions and benefits for each individual, possibly by shifting to what has here been called quasi-actuarial systems. In the context of such a system, it is also technically easy to have a flexible retirement age without individuals being able to shift the costs of early retirement upon others. I have also mentioned that

[18] This type of observation has been made about welfare-state arrangements in general by Freeman (1995) and Atkinson (1999).

compulsory saving accounts with individual drawing rights, combined with compulsory insurance systems, provide an interesting response to increased heterogeneity among individuals and to demands for placing greater responsibility on the individual for his own economic security.

The most obvious argument for a shift to an actuarially fair, fully funded pension system is perhaps to favor future generations at the expense of currently working generations – if such a redistribution is regarded as "ethically fair". One specific twist of this argument is to expand the capital stock in order to compensate *either* for reduced national saving when the pay-go system was introduced, *or* for distortions of saving and investment decisions via the existing capital-income tax system. If we start from a pay-go system with a weak (or non-existing) marginal link between contributions and benefits for individuals, a shift to a fully funded system will also result in an efficiency gain via smaller marginal tax wedges – in the same way as when such a pay-go system is replaced with a quasi-actuarial system.

But there is also a "portfolio diversification" argument for a *partial* shift to a fully funded pension system. The reason is that the returns on pension claims are not completely correlated among pension systems. A partial shift would provide individuals better balanced portfolios of pension claim than either a pay-go or an actuarially fair system alone. This is an important point in a world with both different types of markets risks (risk in earnings versus risk in returns on capital markets) and different types of political risks (such as different strength of property rights in different types of pension claims). The most severe problem inherent in a (partial or complete) shift to a fully funded system lies in finding ways to avoid politicization of the domestic economy. The only reliable way of achieving this is probably to let pension funds be privately owned and operated from the outset, and to allow individuals to choose fund managers – possibly combined with caps on the administrative fees to pension fund managers.

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