Social insurance based on personal savings accounts: a possible reform strategy for overburdened welfare states?

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1. Introduction (1)

A central dilemma for overburdened welfare states is that many proposed reform strategies either lead to higher marginal effects of taxes and subsidies (called the marginal tax rate from here onwards) or deepen poverty. Cutbacks, for example, that maintain the standard of living of the poorest reduce benefits more for those with medium or higher incomes. This tends to make social insurance less actuarial and thus raises the marginal tax rate. Cutbacks that actually reduce the marginal tax rate generally imply that people have to rely more on own saving and private insurance and this typically hurts low-income groups who face the highest risks of, for example, unemployment and sickness.

This dilemma can to some extent be resolved by building social insurance around a personal savings account. Detailed simulations indicate that it is quite possible to design a combination of mandatory personal savings and insurance that slashes the marginal tax considerably and yet maintains or even improves upon the economic security offered by welfare states.

Such a claim may at first seem surprising. Social insurance based on personal savings has often been viewed as incompatible with the aims of western welfare states, partly because countries like Singapore that have savings-account-based systems provide very little redistribution (2). Yet there are good theoretical reasons why a savings account can also increase efficiency in a system with extensive redistribution.

The basic idea is that mandatory payments into a personal savings account replace most of the taxes currently used to finance unemployment benefits, sickness benefits, parental leave, pensions and all other social insurances. When the need arises, people are allowed to withdraw from their account instead of receiving benefits. At retirement the balance on the account is converted into an annuity that determines the pension level. Various insurance elements which are described below provide protection for those who deplete their account, typically due to a combination of low wage and frequent spells of income loss.

One reason why savings accounts may be an increasingly interesting feature in a welfare system is that life styles have changed considerably over the past centennium. When welfare systems were conceived in most western countries, only a small portion of adult life was spent not working, and most of that could be ascribed to insurable events. Today, more than half of a typical person's life is spent in spells of non-work that are often highly predictable, even planned, and hardly qualify as insurable events. In fact, studies from several welfare states indicate that a mere 20 to 25 % of social transfers actually redistribute between individuals, thus covering the two central aims of the welfare state of providing insurance and equality. The remaining 75 to 80 % merely smooth income over the individual's life cycle (ESO, 1994).

Importantly, the arguments for a savings-account-based insurance outlined below do not require a funded system, but arise even in a pay-as-you-go system with simulated accounts on which drawing rights are accumulated. If one chooses to convert an extant pay-as-you-go system into a system of funded personal savings

(1) The views expressed in this paper represent exclusively the positions of the author and do not necessarily correspond to those of the European Commission. I would like to thank Dennis Snower, Assar Lindbeck, Per Lundborg and Tony Atkinson for valuable comments.

(2) See Asher (1994) for a description of the Singaporean Central Provident Fund. Originally designed to increase savings and to provide retirement security it has since been extended with a number of schemes, for example saving for medical needs, financing of higher education, insurance of dependants and a variety of other social needs.

accounts, there are additional opportunities and risks that are not treated here [1].

1.1. Lower marginal taxes

Introducing a savings account into social insurance lowers marginal taxes for two reasons. First, programmes that provide income-smoothing over the life cycle are most commonly entitlement systems in which benefits are poorly related to contributions, thus creating a tax wedge. A savings account explicitly records individual's deposits and withdrawals, thus avoiding most of the tax wedges created by quirks in entitlement rules.

Second, to the extent that social insurance deals with insurable events, both tax-financed transfers and actuarial insurance face a dilemma. Payment of the tax or insurance premium — as well as payment of the benefit — must be conditional on declared income. This implies a clear presence of moral hazard. At least some individuals are able to abuse the transfer system or insurance by voluntarily earning less or by earning undeclared income. The presence of moral hazard implies that even an actuarial insurance gives rise to disincentives that are equivalent to marginal effects of taxes and subsidies. Unemployment compensation, for example, reduces incentives to work regardless of whether the compensation is provided by an actuarial insurance or a tax-financed system.

Moral hazard can be addressed by introducing a deductible. The size of the deductible is limited, however, by the desire of welfare states to maintain a minimum standard of living. Thus, for people with a wage close to the acceptable minimum standard, the deductible is effectively constrained to zero [2].

Social insurance based on a personal savings account addresses this problem by using the account to shift premium payments and deductibles from periods where the individual has a low income to other time periods during which the individual may have greater incentives or ability to earn a higher income. As a result, the savings account allows a greater deductible than standard actuarial insurance, without compromising the minimum standard of living in any period [3].

To study the importance of these two effects on the marginal tax rate, a simulation of introducing a savings-account-based social policy in Sweden is presented below.

1.2. Increased economic security

Increasingly, cutbacks in welfare states imply that people with low incomes face increasing economic risks. At the same time, these groups often have less access to borrowing and other means of spreading extraordinary costs over time. As a result, low-income groups increasingly live in economic insecurity, even when they manage on average. The introduction of an account will provide these groups with a better instrument for smoothing income over time [4].

More importantly, a savings account is an excellent device for keeping track of which individuals fare poorly throughout life. Instead of insuring each type of mishap separately, as most current systems do, a savings account allows an insurance that best protects those who are affected by a combination of low income and frequent income losses over most of their lives. A redistribution and insurance mechanism that accomplishes this can be designed in many different ways.

(1) Many studies find that pay-as-you-go systems imply lower national savings and aggregate capital stocks than funded systems. However, switching from a pay-as-you-go system to a funded system means that an increase in savings may be matched by an increase in public debt required to finance unfunded promises to retirees. According to some economists (for example Mitchell and Zeldes, 1996), this implies that national savings would not increase at all. Others (for example Feldstein, 1996), however, show that in a growing economy savings in the funded system will quickly outgrow the fixed sum of promises to retirees at transition. In support of this case Chile is often cited, since it managed to switch from a generous pay-as-you-go system to a funded system during the 1980s with a surprisingly mild increase in national debt and a large increase in private savings and investment.

(2) Even user fees charged for subsidised public services such as childcare and public health care can be seen as a deductible in the presence of moral hazard.

(3) This mechanism will not work if all individuals are either always poor or always have high incomes. Studies indicate, however, that income variability is considerable in European welfare states. An OECD study ('Employment outlook', July 1996) shows, for example, that half of the people in the lowest income quintile in the United Kingdom in 1986 had moved to a higher income group by 1991.

(4) If the personal savings accounts are funded, there is an additional way to improve the economic security channel. In conventional systems, individuals accumulate future entitlements which cannot be used to cushion credit risks or temporary liquidity squeezes that many households face, for example, when purchasing a home. In a savings-account-based social insurance, individuals can be allowed to borrow from their own savings account for home purchase, thus reducing the risks of credit and liquidity problems considerably. In the Singaporean system, this seems to have worked well for some time, and has allowed many low-income earners to purchase homes.

One approach is illustrated by describing the two mechanisms that were used in the simulation reported below:

(a) Life income insurance

The balance that has accumulated on the account at the time of retirement is converted into an annuity, thus determining the individual's pension rights. At that time, claims against the life income insurance are also calculated. Paralleling most social insurance systems, the life income insurance grants a person who has saved little on his account because he chose not to work at all throughout life only the lowest guaranteed pension. In contrast, a person who has worked part of his life, but has then been unemployed or disabled, receives a higher guaranteed pension, but not as much as he would have had if he had worked and built up a balance on the account.

(b) Liquidity insurance

The savings account guarantees liquidity in the sense that withdrawals from the account can be made even when the balance is zero or negative. Withdrawals are regulated and administered much like benefit payments in other social insurance systems. In addition, a limit to the debt that can be accumulated on the account is assumed, for the same reason that bankruptcy laws allow write-offs of debt. Too large a debt burden makes it improbable that the individual can ever repay the debt. When the debt limit is reached, withdrawals from the account are covered by public (non-actuarial) insurance.

This paper focuses on the effects that arise in a pay-as-you-go system with simulated accounts. In particular, the question is how much marginal taxes may be reduced in a realistic setting without jeopardising the aims of the welfare state. A simple model of social insurance is set out in Section 2 and is used as a basis for the simulations reported in Section 3.

2. A model of social insurance

Assume initially that there is symmetric information between the individual and the insurer: at the beginning of each period both know the individual's wage w_t during period t as well as expected future values of w_t. The individual pays m_t which can be either a tax or an insurance premium. After that he learns his actual income y_t which may be lower than w_t due to income losses. At the same time, new information about the likelihood of future income losses is revealed. He then receives compensation x_t for income losses and consumes c_t. Between periods the person earns interest 1 + r, and for simplicity it is assumed that the discount factor β equals 1/(1+r). The argument is not affected by different values or varying interest rates.

Expectations, conditional on time t information before y_t is revealed, are denoted E_t. Thus $E_0\ y_0$ refers to the expected value of y_0 in the first half of period 0, before y_0 is revealed.

Consumers maximise a standard intertemporal utility function:

$$\max.\ E_0 \sum_{t=0}^{\infty} \beta^t u\,(c_t) \qquad (1)$$

Assume initially that there is no moral hazard. The individual cannot avoid declaring income, reduce work effort or otherwise influence own income losses.

A universal welfare state system will typically finance social insurance with an income-related tax or non-actuarial insurance premium, $m_t = \tau\ y_t$. The tax rate τ is assumed to be proportional and constant over time. In return, the individual receives a compensation $x_t = (w_t - y_t)\ (1 - \tau)$. Suppose that in this system the initial expected value of tax payments must balance the expected payments of compensations:

$$E_0 \sum_{t=0}^{\infty} \beta^t\ \tau\ y_t = E_0 \sum_{t=0}^{\infty} \beta^t\ (w_t - y_t)(1-\tau) \qquad (2)$$

If w_t were constant and the information about expected values of y_t remained constant, this would constitute an efficient arrangement. Given a concave utility function the individual's utility is maximised with a constant consumption stream, in this case $w_t\ (1 - \tau)$.

In fact, however, w_t can vary and information on expected values changes between periods. As a result the tax an individual pays in any period will differ from the actuarial premium. In addition, the consumption stream is no longer constant, and therefore no longer pares to optimal even though the State would care nothing about rearranging payments to provide a constant consumption stream.

A similar problem arises for a voluntary insurance ([1]). Assume that the insurer is risk neutral and competitive, and can borrow or lend at the interest rate r. Risk neutrality implies that individual income loss is a perfectly diversifiable risk. Competition among insurers is assumed to imply zero economic profits. Then the Pareto-optimal insurance contract can easily be found under the assumption that complete contingent claims' markets exist. At time 0 the individual sells claims to his income stream and buys contingent claims to cover income losses. Then the individual's time 0 budget constraint is

$$E_0 \sum_{t=0}^{\infty} \beta^t c_t = E_0 \sum_{t=0}^{\infty} \beta^t y_t \qquad (3)$$

Maximising utility (1) subject to this constraint yields first-order conditions that specify a constant consumption level c at every date and in every welfare state. Solving the budget constraint with constant consumption gives

$$c = r\ \beta E_0 \sum_{t=0}^{\infty} \beta^t y_t \qquad (4)$$

([1]) For the case of health insurance, these problems are analysed in Cochrane (1995).

The time 0 contingent claim contract is, however, not time consistent. As soon as new information on expected values of future y_t is revealed, insurers will try to get rid of individuals with deteriorating prospects. This effect could possibly be avoided with the help of regulation. What is worse is what happens if the individual's prospects improve. The individual will then cancel the insurance, making it impossible for the insurer to cross-subsidise those with income losses. Thus, a voluntary social insurance requires lifetime ties in order to work. Such lifetime ties to private insurers are probably in conflict with legal principles in most current welfare states.

Cochrane (1995) suggests a mechanism for the related case of health insurance that could solve the problem of time inconsistency. The essence of the approach is to adjust the insurance premium in every period to reflect changed information on expected income losses, and at the same time require side payments each period that reflect the present value of changes in expectations of income losses. Thus an individual whose prospects deteriorate would receive a payment from the insurance company equalling the net present value of increases in future income losses. Vice versa, the individual would have to make a payment to the insurance company if prospects improve.

In order to enforce the contract in a situation where individuals can go bankrupt, Cochrane's mechanism requires a savings account in which savings at any time equal the possible payment that a client may have to make to the insurance company. Thus the time inconsistency problem can potentially be solved with the help of a savings account.

An obvious way around the time inconsistency problem in both Cochrane's mechanism and the universal welfare state arrangement is to introduce a mandatory, public, actuarial insurance. The insurance premiums would then be set as implied by (3) and (4), while the time consistency problem would be suppressed since it would be impossible to switch insurance company.

So far, however, the analysis misses the essence of the welfare state dilemma. Social insurance, whether privately or publicly arranged, remains susceptible to moral hazard. In fact, the presence of moral hazard is the main motivation for attempting to keep marginal tax effects low in social insurance.

Assume that an individual can influence his income stream in a way that the State or insurer cannot detect, for example by pretending to be sick or unable to find employment. Let the new income stream y_t' be the result of the individual's utility maximisation. Let utility be a function $u(c_t', l(y_t - y_t'))$ of consumption c'_t and the additional leisure $l(.)$ that the individual gains by manipulating his income from y_t to y'_t. The utility function satisfies that for a constant consumption level a voluntary income loss is preferred, since it allows more leisure. This implies that $y_t' < y_t$. Further, if x_t' compensates for the entire income loss s.t. $x_t' = (w_t - y_t')(1 - \tau)$, then the individual's utility maximisation implies $y_t'(x_t') = y_t'((w_t - y_t')(1 - \tau)) = 0$.

In order to avoid this, a deductible must be introduced. We assume that the deductible is determined by a rule D that assigns a particular D_t in every time period, conditional on variables such as w_t, y_t' and other variables, but not on y_t which is assumed to be unknown to the State or insurer. The compensation paid is then $x_t' = (w_t - y_t')(1 - \tau) - D_t$.

Assume a public, mandatory, actuarial insurance that, apart from the deductible, allows a constant consumption stream. Going through the same steps that led up to (4), the individual's consumption in any period with moral hazard and a deductible becomes

$$c'_t = - D_t + r\beta E_0 \sum_{t=0}^{\infty} \beta^t (y'_t + D_t) \qquad (5)$$

Since y_t' is decreasing in D_t, a lower deductible lowers the individual's consumption stream. Since the insurer or the State still makes zero profit and is therefore indifferent to the size of the deductible, the socially optimal design of the system can be found by maximising the individual's utility w.r.t. the rule D that determines the size of the deductible in each period.

In doing so, there is an important constraint. In each period the individual must have a minimum to live on — call it MIN. This limits the size of the deductible. The maximisation problem is then as in (6), where y' as defined above is the individual's optimal choice of declared income.

$$\max E_0 \sum_{t=0}^{\infty} \beta^t u(c'_t y_t - y'_t)$$

$$\text{s.t. } D_t \leq (y'_t (1 - \tau) - \text{MIN})/(w - y'_t)(1 - \tau) \qquad (6)$$

Since the condition must be met for any y_t', it is clear that it is quite restrictive.

The constraint can be made less restrictive, however, by introducing a savings account. We assume a very simple version of the savings-account-based social insurance. Assume that a deposit is made on the savings account in any period in which income y_t' exceeds MIN and the balance on the account is below some maximum amount. The balance on the account is, in a sense, the individual's money, and the individual earns interest. In every period an annuity based on the balance in the account is returned to the individual [1]. Yet the individual's expected value of making the mandatory deposits on the account is, of course, smaller than the actual deposits since expected future withdrawals must be taken into account.

The size of the deposit on the account in any period is A_t and the maximum amount is governed by a rule A which we do not need to specify to make the point.

Similarly, withdrawals from the account are governed by a rule V that determines a withdrawal V_t in any period. The withdrawal is zero if either the balance on the account is zero or if the constraint in (5) is met. In this case the insurance takes over. Otherwise the withdrawal V_t is positive. Since this means that the deductible can be completely or partly paid with a withdrawal this means that the new restriction for the maximisation problem (6) becomes

$$D_t \leq (y'_t\,(1 - \tau) - MIN + V_t)/(w_t - y'_t)(1 - \tau) \qquad (7)$$

Clearly this constraint is less restrictive, which means that the deductible can be made larger due to the account than would otherwise be possible.

The model does not say much about the size of the effect. Intuitively it is obvious, however, that this depends on the probability distributions of w_t and y'_t. If the world divides into individuals that never have an income loss ($y'_t = w_t$) and individuals that have a complete income loss in every period, then the account will make little difference. Those with persistent income losses, persistently have $V_t = 0$ so that (7) is identical to the restriction in (6).

The potential for reducing marginal tax effects with the help of savings-account-based social insurance is investigated for the case of Sweden in the following simulation.

[1] In a model with a finite working life, the balance on the account would be returned as well at retirement.

3. A simulation

The simulation analyses a comprehensive reform of the entire Swedish social insurance system. This is important since social insurance programmes often interact in ways that make it misleading to look only at the effect of reforms on one programme at a time.

A limitation is that the simulations only show the direct effects of the choice of social insurance system on marginal tax effects and income distribution. In reality these direct effects then yield indirect effects on, for example, labour supply and take-up rates in the social insurance programmes, which, in turn, influence the average person's marginal tax rates and income distribution. These indirect effects are not calculated here. Since empirical estimates of individuals' adjustment to changing marginal tax rates vary widely, any assumptions about the size of these effects would be quite ad hoc. Instead, our simulation of direct effects lends itself to the interpretation that a change of social insurance system that, for a given income distribution, induces the largest direct reduction of marginal tax rates also induces the most favourable indirect effects.

The simulation is described in four steps. First, the construction of the life cycles is explained. Then the implementation of the personal savings account and an alternative actuarial insurance are described. Finally, simulation results are shown.

3.1. The simulated life cycles

The calculation is based on a simulated population of 1 000 persons. It is also assumed that all incomes and prices remain as in 1990 in real terms. Life cycles begin at age 20 and end at death.

There are four steps in the construction of the simulated population:

1. The distribution of pre-tax simulated wages is first determined. The simulated population is divided into six groups (male or female with no secondary education, secondary education and tertiary education respectively) using the frequency distributions in the actual population (1). For each group the mean wage in year t is determined as

$$m_t = m_g + \Theta t - \delta t^2 \qquad (8)$$

This yields the typical parabolic income pattern over time. m_g is a constant that differs for each of the six groups. In addition, the individual's wage w_{it} differs from the mean by a random walk process. Let u_{it} be a random variable which is distributed independently of income and previous proportional changes; then if $z_{it} = \log(w_{it}/m_t)$ the generating process can be written as

$$z_{it} - z_{i,t-1} = u_{it} \qquad (9)$$

If u_{it} has a constant variance of σ_u^2 and if σ_t^2 denotes the variance of z_{it} then (9) implies that

$$\sigma_t^2 = \sigma_0^2 + t\sigma_u^2 \qquad (10)$$

and the variance of the logarithms of income in each year grows linearly over time. Therefore, information on the variance of earnings in different age groups provides estimates of (10).

Estimates of the parameters in (8) and (10) were jointly estimated using a maximum likelihood method (as done, for example, in Cameron and Creedy, 1995) (2) The simulated wage distributions are consistent with estimates obtained in various studies that analyse wage panel data (3). Note that in our simulations we assume that there is no productivity growth.

(1) The distributions of these variables are provided by the Swedish Central Office of Statistics for 1990.

(2) Estimates obtained are $\sigma_0^2 = 0.173$; $\sigma_u^2 = 0.0049$; $\theta = 0.0311$; $\delta = 0.00071$; $m_{\text{male, no sec ed}} = 8.91$; $m_{\text{male, sec ed}} = 9.54$; $m_{\text{male, tert ed}} = 10.3$; $m_{\text{female, no sec ed}} = 8.70$; $m_{\text{female, sec ed}} = 9.14$; $m_{\text{female, tert ed}} = 9.8$.

(3) In particular, Björklund (1993).

2. To generate lifetime earnings, first the pre-tax wage is calculated for each individual, rewriting (9) as

$$w_{it} = w_{i,t-1} \exp[(m_t - m_{t-1}) + u_{it}] \qquad (11)$$

This can be used to generate the w_{it}'s given a set of random variations from an $N(0,\sigma_u^2)$ distribution (1). Capital income and capital taxation are ignored in the simulation of individual income streams, but enter the State's balanced budget requirement described later.

Subsequently, after-tax earnings I_{it} are calculated as

$$I_{it} = \begin{cases} w_{it} - T(X_{it}) + B(X_{it}) & \text{if i is working} \\ - T(X_{it}) + B(X_{it}) & \text{if i is sick, retired, on parental leave, in tertiary education, involuntarily unemployed, or voluntarily not working.} \end{cases}$$

Here T(.) is a schedule of taxes and/or deposits on the personal account, and B(.) is a schedule of benefits and/or withdrawals from the personal account. Both depend on a vector X_{it} that describes the individuals' history in terms of earnings, employment record, number and age of children and other aspects that determine tax and benefit rates. These are described further below and in the appendix. Family history, which typically is the most complicated part in a life-cycle simulation, has been considerably simplified here. Since Swedish tax and benefit rules with few exceptions are geared towards the individual with no regard to marital status, we have for the most part ignored marital status (2). Thus individuals in the life-cycle model are not 'matched' to each other to create families. Each individual has children with a certain probability and bears half the costs associated with children, for example child-care fees.

3. It is assumed that all people retire at 65 years of age, unless they fall ill and enter early retirement. The age of death is determined randomly according to the actual distribution of mortality. This differs for men and women but is assumed to be independent of other variables.

4. Sickness, voluntary and involuntary unemployment parental leave, and tertiary education are determined as follows. We assume that spells of sickness are equally likely for all categories at all stages in life, but that the duration of spells varies according to a probability table which depends on sex, age, current income, and the share of the previous five years during which the individual has been either sick or unemployed (3). Spells of sickness beyond three years in length are assumed to imply early retirement. Individuals who retire early do not work at all until they reach the age of 65 when all individuals enter normal retirement. Spells of involuntary unemployment and voluntary non-work are randomly assigned based on probability tables where the length of the spell depends on age, income, sex and the share of the previous five years during which the individual has been either sick or unemployed (4). The occurrence of child birth is determined randomly according to the actual distribution. It is assumed that when a child is born a mother is on parental leave for 90 % of 1.25 years (the time compensated by parental leave insurance) and a father for 10 % of 1.25 years. This corresponds to aggregate statistics. Participation in tertiary education is determined randomly according to aggregate frequencies as described above. A person engaged in tertiary education is assumed to participate for five years, during age 20 to 24.

A weakness of such simulation models is that they do not capture all cross-effects well. For example, no account is taken of how education may affect sickness or the probability of having children. As one measure of robustness, however, a study using an alternative technique — creating life cycles by splicing together panel data — yielded similar distribution of lifetime income, unemployment and sickness (ESO, Ds, 1994:135).

Using the simulated income pattern and the simulated work history, payments into the social insurance in the form of payroll taxes and income taxes are calculated. Then income before and after transfers is derived (5). Based on these data, it is then easy to ascertain amounts

(1) To generate wage in the first period w_{i1} for example, suppose that v_i is randomly selected from the standard normal distribution N(0,1), and use $w_{i1} = \exp(m_1 + v_i \sigma_u)$.

(2) An exception is social assistance payments that are conditional on the spouse's income. This is implicitly handled in the simulation by using a probability of being eligible for welfare given that the individual is out of work and does not have unemployment insurance.

(3) The probability tables are provided by the Swedish Health Insurance Authority for the year 1990.

(4) Data underlying the probability table are provided by the Swedish Labour Market Board.

(5) Transfers are calculated in a simplified manner. Additional negotiated compensations are ignored.

transferred between individuals on a lifetime basis. Since we assume constant real prices and wages, the real interest rate (r) earned on savings in the personal savings account is assumed to be low, only 2 %. The simulation is not affected by whether the personal savings account is organised as a pay-as-you-go system or a reserve system since changes in the savings rate are not endogenised.

3.2. Design of the personal savings account

There are many ways to implement the concept of a savings-account-based social insurance. The intention here is to design a savings-account-based social insurance that provides the same income distribution and economic security as the current Swedish social insurance system, but significantly lowers marginal tax effects. In fact, the rules governing the personal savings account are rigged to give exactly the same disposable income y_{it} as the current system up to the age of 65. At age 65 the balance on the personal savings account is converted into an annuity, and thus determines the pension level, subject to the insurance elements described further below.

Up to the age of 65, payments into the personal savings account are mandatory and would be collected much as taxes are today. For comparability it is also assumed that the sum of mandatory payments into the account (A_{it}), insurance premiums (S_{it}, S_{it}, < 0 for premiums, $S_{it} > 0$ for compensation), and taxes in the savings account system (T_{it}^{CA}) equal taxes paid in the current system for each individual (T_{it}):

$$T_{it} = A_{it} - S_{it} + T_{it}^{CA} \qquad (13)$$

The insurance premium is not entirely equivalent to a tax since it has an actuarial element. Higher income, leading to higher deposits on the account, and higher insurance premiums also imply higher guaranteed pensions (1). Withdrawals from the personal savings account (V_{it}) and insurance compensation (S_{it}) are regulated and vary with the cause of income loss, previous income and other factors, just as benefit levels (B_{it}) do in the current system:

$$B_{it} = V_{it} + S_{it} \qquad (14)$$

(1) On the other hand, there is a hidden tax due to the redistribution between men and women, and childless people and parents explained below.

The personal savings account as constructed here incorporates the two insurance elements, briefly described above. The exact tax and social insurance rules applied in the simulation are shown in the appendix.

(a) Life income insurance

The balance on the personal savings account accumulates as $\Sigma_{t=1} (A_{it} - V_{it})(1 + r)$ up to the age of 65 when it is converted into an annuity, thus determining the individual's pension. At that time claims against the life income insurance are also calculated. The life income insurance accumulates guaranteed pension rights throughout life. This bears some resemblance to private pension plans that guarantee some pension even if the return on invested savings develops poorly.

The guaranteed pension is calculated as a linear function of a minimum pension level that everyone is guaranteed, and a fraction of the average payments into the account over the 47 years between age 18 and 65.

$$\text{Guaranteed pension} = \text{Minimum pension} + g\, \Sigma_{18} A_{it}/47$$

When the guaranteed pension exceeds the annuity calculated on the balance of the personal savings account at age 65, then the insurance pays a compensation amounting to the difference between the guaranteed pension and the annuity.

Two important redistributionary flows in the current system are retained in the personal savings account system. One is that there is a redistribution from men to women who would otherwise receive lower pensions since they tend to live longer (2). The other is that there is a transfer from people who do not have children to people who have children (3).

(b) Liquidity insurance

The personal savings account guarantees liquidity in the sense that withdrawals from the account can be made even when the balance is zero or negative. In addition, a limit to the debt (LIM) that can be accumu-

(2) Female life expectancy is used to calculate the pension annuity. This means that men are undercompensated. The surplus that arises helps to finance the insurance premiums required by the system.

(3) For individuals with one or no children, a sum is deducted from the citizen account at retirement before calculating the annuity. The sum equals 3.5 % of life earnings net of taxes for those with no children and half that for those with one child.

lated on the personal savings account is assumed, for the same reason that bankruptcy laws allow write-offs of debt. Too large a debt burden makes it improbable that the individual can ever repay the debt, and thus decreases incentives to achieve gainful employment. When the debt limit is reached, withdrawals from the account that the individual is eligible for are compensated by the insurance.

A constraint applied in the simulation is that the government budget balance in the savings account system is the same as in the current system. This implies that g, LIM, the minimum pension, and the size of insurance premiums are set so that the sum of insurance premiums and insurance compensations matches over all individuals and all time periods:

$$\Sigma_i \Sigma_t S_{it} = 0$$

The values that fulfil the constraint are found by numerical calibration. The minimum pension is set to the same level as in the current system, LIM = SEK – 220 000 and g = 0.26. These values work both for the wide and for the narrow version of the savings account. At these parameter values, it turns out that 14 % of all people end up using the guaranteed pension. Further, the insurance premiums are set at 21 % of payments into the account in the narrow version, and 19 % in the wide version, as explained below.

We analyse two implementations of the personal savings account, one narrow and one wide. Table 1 shows the range of benefit programmes encompassed by the two versions. The exact rules for the financing of each programme, and the levels of compensation paid, are supplied in the appendix. Public expenditure on various transfers is shown in gross terms (ignoring for the moment that it is often taxed and therefore partially recouped by the government). In the narrow version, public expenditure amounting to 9.25 % of GDP would be channelled via the personal savings account system, although a fraction of that would pay for insurance premiums rather than being deposited in individual accounts. In the wide version, public expenditure amounting to 41.8 % of GDP would be channelled via the personal savings account system. These figures should be compared with a total tax revenue of 48 % of GDP and total public expenditure of 68 % of GDP in 1994.

In the narrow version, neither the pension system n provisions for the elderly are subsumed under the pe sonal savings account system. Rather it is assumed th savings on the account are converted into an annuity the age of 65 and added on to pensions allowed by th current pension system (1).

In the wide version, it is assumed that the pension sys tem is subsumed under the personal savings accour system (thus working much as it will anyway after th move towards a contribution-based pension system i implemented). Again, savings on the account are con verted into an annuity which constitutes the pension.

In the wide version, it is assumed that most social insur ance and transfers to households are replaced com pletely by the account. In public services, howeve payments are only partially made via the account. I health care, for example, it is assumed that fees ar charged for common health services, amounting in sun to about 50 % of total health-care costs. These fees ar financed via the account. The remaining 50 % ar assumed to remain publicly financed, covering high- cost operations as well as a number of minor function such as health research or disease control. In essence this provides an additional insurance against the risk o very costly health-care needs (2). A number of studie suggest that this type of cost-sharing could raise efficiency in health care (for example Jönsson, 1995).

Schooling in the wide version is assumed to be financed via the account covering half of total costs. The remainder is publicly financed which can be justified by the fact that schooling presumably has positive external effects.

We assume initially that early retirement remains as in the current system. In the event of early retirement, public insurance pays 70 % of current wages. From this deposits are made on the citizen account as though income were a regular wage. The balance on the account then determines old-age pension as for all other people.

(1) However, a fixed sum equal to the average annuity is subtracted from pensions in order to keep the sum of annuities and pensions in aggregate equal to the sum of pensions paid under the current system.

(2) It is assumed that health-care costs, including costs of medicines, are financed individually up to a sum of SEK 15 000 per year via the citizen account. Costs beyond that are paid publicly. For retired people, the deductible is financed out of pensions provided this does not push them below the minimum pension level. This would imply that about 50 % of health care and drug costs are financed via the account.

Table 1

Benefits and public services encompassed by narrow and wide definitions of the personal savings account

Benefit	Programme's cost in terms of % of 1994 GDP	Share assumed financed via savings account (1) %
Narrow		
Unemployment benefit (2)	3.7	100
Parental leave	1.5	100
Sick benefit	1.3	100
Child benefit	1.2	100
Welfare	0.93	100
Housing benefits	0.62	100
Narrow total	9.25	100
Wide		
Pensions (3) (4)	13.6	100
Housing subsidies	2.1	100
Student loans (5)	0.7	100
Education for the unemployed	1.0	100
Miscellaneous transfers (6)	2.7	100
Health care	9.6	50
Childcare	2.6	100
Schooling	4.3	50
Miscellaneous subsidies and services (7)	4 7	75
Wide total (adjusted by share financed via the account)	41.8	—

(1) Not counting public costs of insuring the account.
(2) Includes benefits for training during unemployment (AMU).
(3) Includes housing benefits to the elderly.
(4) Includes early retirement and work injury.
(5) Net of repayments.
(6) Includes, for example, transfers to divorced parents.
(7) Includes subsidies to sport and entertainment, energy, food, renovation of houses, employment, medicine and services related to these subsidies.

Since this is a rather generous system, and the life income insurance provision in the personal savings account offers a natural alternative organisation of retirement insurance, we also investigate another, less generous, possibility. In this version, in the event of early retirement, withdrawals are allowed from the account at a rate determined by the accumulated DGAs in the life income insurance. This would imply that young early retirees receive lower benefits than older early retirees.

Further, it is assumed that all withdrawals from the citizen account related to care of children must be made in equal proportions from both parents' accounts. This effectively prevents families from trying to abuse the life income insurance by placing the entire burden on one parent's account.

3.3. Actuarial insurance without a savings account

As a benchmark we also perform simulations for a simple actuarial insurance without a savings account. The term actuarial insurance may be somewhat misleading. As shown in the theoretical model, a savings-account-based insurance may in the end be more actuarial than a conventional actuarial insurance in the presence of liquidity constraints.

An actuarial insurance scheme could be implemented in many different ways, depending on assumptions about the information that the insurer can use about each individual's actuarial risk. Here we use a very simple specification. It is assumed that the premium paid by each individual in any year exactly equals the expected value of compensation payments during the same year for people with the same age, sex, current income, and length of education (1). A constraint exists, however. If the actuarial premium charged is so large that the individual's disposable income falls below the level of welfare payments, i.e. the minimum acceptable living standard, then a lower premium is charged, leaving the individual with the minimum living standard (2). In effect, the insurance is subsidised for low-income earners, and the subsidy is withdrawn as income rises.

Compensation payments paid by the actuarial insurance are assumed to equal those in the current system. The actuarial insurance is applied to the same social programmes as the narrow version of the personal savings account, thus avoiding the issue of how to deal with the pension system, health care and schooling under an actuarial insurance.

A real actuarial insurance would presumably also insure against year-to-year changes in risk in ways that we have not taken account of here. It remains unclear how that affects the result.

3.4. Simulation results

Marginal tax rates are calculated in the simulation by letting each simulated person earn SEK 100 more during one year at a time. Then the relation between the SEK 100 increase in gross earnings and the discounted (by 2 % annually) sum of increased current and future net earnings y_{it} can be calculated:

$$0.01 \sum_{t=j}^{\infty} y_{it} \frac{1}{(1+r)^{t-f}}$$

This quotient is defined as the marginal tax rate and is shown as an average over all individuals and over all time periods; j = 18.65 in the tables below.

Table 2 shows what happens when the current system is replaced by a personal savings account system. Results are shown for three versions of the personal savings account: the narrow version, the wide version, and the wide version with a less generous early-retirement provision as described above.

The marginal tax rate is calculated as explained abo It includes marginal effects in the current system of p gressively increasing fees for public services a decreasing subsidies. The marginal tax rate is fi shown as an average for all people and then for diff ent income groups (3).

Income is here defined in two ways. First, deciles i distribution of lifetime income (after taxes and sub dies) are shown. In the current system, marginal t rates are highest for high-income earners, due to pı gressive taxation, and low-income earners, due to pı gressively reduced subsidies.

With the various versions of the personal savin account, marginal tax rates are much lower and mo equal for all deciles except the first decile. The reason that people in the first decile at retirement tend to ha less on their account than the minimum guarante amount. As a result, they still have some incentive earn income as this raises the guaranteed pension, b the incentive is naturally much lower than for someo who ends up with more than the guaranteed amount c the account.

Table 2 indicates that our implementation of the actua ial insurance does not have equally large effects on th marginal tax rate as the narrow version of the citize account. The main reason seems to be that the constrai stating that individuals' minimum living standard shoul be preserved has a large effect. The groups with the low est income in any particular year tend also to have hig risks of income loss during that year even though the may have low risks and high incomes in other life peri ods. This implies that their insurance must be sub sidised. Since increasing incomes for these groups impl a reduced subsidy, the marginal effects are very high.

Since the aim of the personal savings account system i to decrease marginal taxes without affecting incom distribution too much, we show income distributions fo the current system and the versions of the personal sav ings account system in Table 3. Income distribution i shown as Gini coefficients for lifetime income and fo annual income, where the annual income includes bene

(1) The expected value is known from the probability tables used in constructing the population, as described above.

(2) The excess costs that arise to the insurance due to this constraint are financed out of tax revenue. It turns out that about 60 % of payments made by the insurance must be tax financed.

(3) Importantly, the marginal tax calculations are based on an *ex post* reasoning *Ex ante,* people will, of course, not know how incomes and withdrawal develop over their lifetime, so that the actually perceived marginal tax rat will be based on expectations of future developments.

Table 2

Marginal tax rates in a simulation of social insurance reform

	Current system	Narrow savings account	Wide savings account	Wide account with less generous early retirement	Narrow actuarial insurance
Marginal tax rate ([1]) in per cent					
Average for all	74	54	37	33	65
Average for deciles in terms of lifetime income					
Tenth decile	80	51	35	32	59
Fifth decile	67	53	36	32	64
Second decile	75	57	44	39	68
First decile	94	85	79	73	89
Average for deciles in terms of monthly income					
Tenth decile	79	50	35	32	50
Fifth decile	68	53	36	32	59
Second decile	73	56	44	39	75
First decile	91	61	51	49	95

([1]) Includes marginal effects of benefits.

Table 3

Life income distribution

	Current system	Narrow savings account	Wide savings account	Wide account with less generous early retirement	Narrow actuarial insurance
Gini life income (per year)	0.119	0.118	0.121	0.122	0.24
Gini annual income	0 281	0.281	0.283	0 284	0.37

fits or withdrawals from the account in order to ensure comparability with the current system.

Clearly, overall income distribution is not much affected by a switch to the personal savings account. This is no surprise for annual income since withdrawals allowed from the account were designed to match current benefits. It is more remarkable, however, that the distribution of lifetime income remains virtually unaffected by a switch to the personal savings account. This corroborates evidence discussed above that only a small fraction of current welfare spending is actually redistributed from high-income to low-income individuals.

These results on overall income distribution do not preclude the existence of redistributionary effects between groups of people that do not perturb the overall distribution. We have performed a number of tests on such effects, but reporting these falls beyond the scope of this paper. A rough characterisation is that people gain with personal savings accounts who work many years at a low wage, which in the current system means that they pay in a lot over the course of their lifetime, but receive fairly low compensations when they are, for example, sick or unemployed. On the other hand, people lose with personal savings accounts who work for only a few years at a high wage, which means that they receive high compensations in the current system even though they pay in rather little over the course of a lifetime.

The actuarial insurance induces a significant shift in the income distribution. It should be remembered, however, that this is based on a particular implementation of actuarial insurance that probably does not cover change risk levels well. In particular, it appears that risks expected compensations are quite high during the a 20 to 35, when many people's incomes are low. T high actuarial premiums essentially push a large fract of this age group to the minimum standard of living.

4. Conclusion

Most countries already have some element of social insurance based on a mandatory savings account. Pension systems and student loans often work this way. A number of countries, among them Sweden, have recently reformed their pension systems, moving from an entitlement system to a savings-account-based system (1). In a number of countries savings-account-based systems are also under consideration for training of both the employed and unemployed. 'Individual learning accounts' were, for example, proposed by the British Labour Party (2).

For other types of social insurance, savings accounts are less common. One example, however, is the Chilean unemployment insurance. Newly employed there are required to save in the form of monthly instalments until savings reach a value of two months' wages. If a person becomes unemployed, the savings are paid back over a four-month period. Only after that does public assistance step in. Saved funds follow employees if they change employer. At retirement saved funds are paid out. In essence, the scheme creates a larger deductible, but helps to spread the impact over a longer time period.

More comprehensive systems of mandatory savings accounts exist in Malaysia and even more so in Singapore (see Asher, 1994).

An important question is what technical difficulties a conversion would face. A savings-account-based social insurance could be introduced for younger people only, thus leading to a gradual transition. It would be quite possible, however, to organise a simultaneous transition for all. This would require that for each type of person an account balance is imputed, depending on age, sex, accumulated tax payments and perhaps a few other variables. A mixture of these approaches is actually being used in Sweden's current pension reform.

(1) A smaller part of contributions in the new system will be channelled into real savings accounts, while the larger part continues to work on the pay-as-you-go principle. In essence, bookkeeping accounts are built up that reflect a drawing right on future generations' payments. Individuals will have some choice as to how the real savings are to be invested.

(2) In 'New deal for a lost generation', presented 15 May 1996.

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Appendix

This appendix describes the tax and social insurance rules applied in the current system, the personal savings account system and the actuarial insurance.

Current system

Tax schedule: From gross income (before employer's tax) the following taxes are drawn:

Employer's tax: 35 %.

Income tax: 31 % of net income (after employer's tax) and additional 25 % for income over SEK 191 000 per annum.

Value added tax: 14 % on remaining income after employer's and income taxes. VAT rate is 19.2 % for most goods and services, but lower for some.

Bargained or voluntary insurance provided by the employer is ignored.

Social insurance benefits

Unemployment benefit: 80 % of previous net income up to SEK 68 000 per annum. In practice, not limited in time.

Parental leave: 80 % of previous net income up to SEK 231 000 per annum, paid for one year.

Sick benefit: 80 % of previous net income up to SEK 231 000 per annum. No compensation first day, 65 % second day.

Child benefit: SEK 750 per month and child.

Welfare: SEK 6 500 per month for an adult, SEK 2 500 per child.

Housing benefits: Vary locally; here we assume the average figure of SEK 1 100 per month for individuals with an income of SEK 6 500, after that reduced by SEK 50 for each increase of income of SEK 100.

Pensions: 65 % of previous net income during 15 years with highest income. Minimum pension for those without previous income is SEK 7 500 per month, which includes supplementary housing benefit.

Student loans: During higher education, SEK 5 000 per month.

Education for the unemployed: Spread evenly over the unemployed, SEK 1 500 per month.

Miscellaneous transfers: Spread evenly over all, SEK 450 per month.

Health care: Own average cost for fees is SEK 60 per sick day. Average system cost for health care is SEK 694 per sick day.

Childcare: System cost is SEK 61 000 per year and child. Parents pay SEK 23 000 per year and child.

Schooling: System cost is SEK 24 000 per year and child, own costs are zero.

Personal savings account

The rules for allowed withdrawals from the citizen account are equivalent to the rules for size of benefits in the current social insurance as stated above. Deposits on the citizen account are calculated as equivalent to taxes paid as described below, minus premiums for the life income and liquidity insurances. Since many of the benefits in the current system are paid out of general tax revenue, it is necessary to allocate taxes to the grammes that are included in the narrow and wide sions of the citizen account. This has been done a lows. The programmes in the narrow versioı assumed to be financed by the entire employer except for pension contributions plus 24 % of direc revenue. The programmes in the wide versior assumed to be financed by the entire employers plus 74 % of direct and indirect taxes.

Expanding the welfare system: a proposal for reform

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