

CEsifo *Working Paper Series*

PENSION REFORM AND DEMOGRAPHIC CRISIS: WHY A FUNDED SYSTEM IS NEEDED AND WHY IT IS NOT NEEDED

Hans-Werner Sinn*

Working Paper No. 195

September 1999

CEsifo
Poschingerstr. 5
81679 Munich
Germany
Phone: +49 (89) 9224-1410/1425
Fax: +49 (89) 9224-1409
<http://www.CEsifo.de>

* Paper presented at the 55th IIPF Congress in Moscow, 23-26 August 1999.

*CESifo Working Paper No. 195
September 1999*

**PENSION REFORM AND
DEMOGRAPHIC CRISIS:
WHY A FUNDED SYSTEM IS NEEDED AND
WHY IT IS NOT NEEDED**

Abstract

Based on explicit present value calculations, the paper criticizes the view that the PAYGO system wastes economic resources. In present value terms, there is nothing to be gained from a transition to a funded system even though the latter offers a permanently higher rate of return. The sum of the implicit and explicit tax burdens that result from the need to respect the existing pension claims is the same under all systems and transition strategies. Nevertheless a partial transition to a funded system may be a way to overcome the current demographic crisis because it replaces missing human capital with real capital.

JEL Classification: H5

*Hans-Werner Sinn
CESifo
Poschingerstr. 5
D – 81679 Munich
Germany
Email: hws@ces.vwl.uni-muenchen.de*

1. Introduction

Should the pay-as-you-go pension system (PAYGO system) be replaced with a funded system, and if so, why? Many authors have expressed many different opinions on this problem, and the matter has been analyzed within highly sophisticated theoretical and empirical models. Some authors, like Feldstein (1995), Kotlikoff, Smetters, and Walliser (1998), Feldstein and Samwick (1998) or Börsch-Supan (1998) and, most notably, Homburg (1990), have constructed models that generate efficiency gains from a transition to a funded system. Others, like Brunner (1996), Fenge (1996, 1997), Sinn (1997, 1998), the Council of Advisors to the German Ministry of Economics (Wissenschaftlicher Beirat beim Bundesministerium für Wirtschaft 1998), and Geanakoplos, Mitchell, and Zeldes (1998), some of whom were inspired by a seminal article of Breyer (1989), have argued that a Pareto improving transition to a funded system is not possible.

This paper will not try to reinvent the wheel, but it can, and will, do two things.

First, it will offer a set of explicit formal present value comparisons between the two systems which are, broadly speaking, in the spirit of the German debate about pension reform from Breyer to the Council of Advisors, but have not, to the best of the author's knowledge, been formally derived before (though they cover the classroom material the author usually presents in his lectures on social policy at the University of Munich). The comparisons will make it clear which arguments the advocates of a funded system should *not* use to defend their case.

Second, the paper will offer another reason why funding pensions might be necessary. This reason relates to the imminent crises of the pension systems of the western world and the lack of human capital formation. It justifies partial funding as a pragmatic solution.

2. A False Reason for Advocating the Funded System

The most frequent reason given in the public policy debate for a funded system is the apparently superior performance of the capital market in terms of the rate of return on investment it can offer. Indeed, many studies have shown how poor the rate of return on PAYGO pension contributions really is.

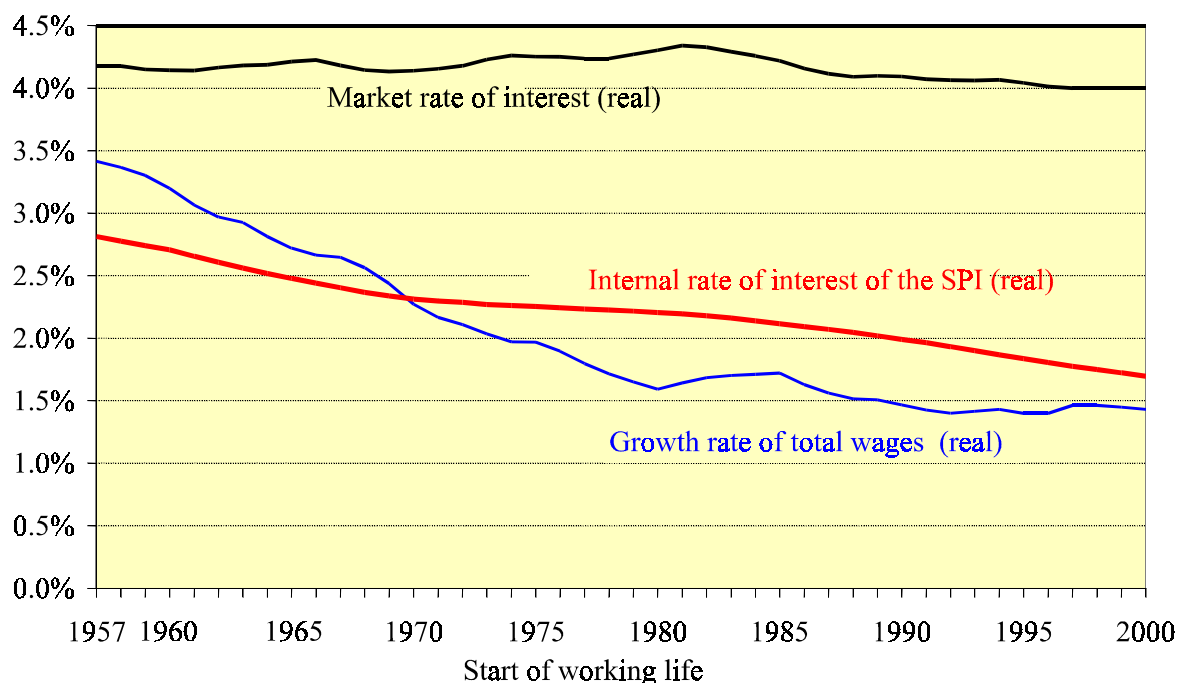
The result of a study carried out by the Center for Economic Studies for the Council of Advisors to the German Ministry of Economics¹ is illustrated in figure 1. In that study the real internal rates of return for alternative age cohorts of average German pension contributors were calculated. The cohorts enter the system at the age of 20 and contribute continually thereafter. Their rate of return is shown for the respective entrance years, where 1957 is the year when the “dynamic” pension system was introduced in Germany. Some members of the cohort die before they receive a pension, some receive disability pensions, some receive old age pensions. Some leave widows and orphans who then receive pensions. In theory, the rate of return should equal the rate of growth of the sum of wages, and the figure shows that this is roughly true if the compound annual growth rate over a 50 year period starting at the respective entrance year is taken as a yardstick. In the calculations up to 1997 actual growth data were used and thereafter an annual increase in the wage rate of 2 %, coupled with the medium demographic forecast of the Statistisches Bundesamt, was assumed.

The figure also shows the compound annual rate of interest of a repeated investment in ten year German government bonds over a period of 50 years starting at the time a cohort enters the pension system. Up to 1997 true data were used and for the subsequent years an interest rate of 4 % which is less than the actual rate in the decades before that date was assumed. Obviously, the rate of return offered by the statutory pension insurance system is significantly lower than that offered by the capital market. Those who entered the system at

¹ Wissenschaftlicher Beirat beim Bundesministerium für Wirtschaft (1998).

the age of 20 when it was founded in 1957, and who will receive their pensions in the Year 2002, would have been able to earn a return of 4.2 % in the capital market, but the PAYGO system just gives them 2.8%. And those who enter now will not receive more than 1.5% while there is no reason to believe that the capital market will generate a return lower than the one it delivered in the past, that is, a good 4 %.

Figure 1: *The internal rate of interest in the German statutory pension insurance system (SPI)*



Source: CES

There is no doubt that the PAYGO system offers a much lower rate of return than the capital market does. Many observers have interpreted this fact as a sign of a fundamental intrinsic inefficiency of the PAYGO system and have therefore advocated a transition to a funded system so as to make use of the higher rate of return that the capital market can offer. However, as the Council pointed out, unless further qualified, this interpretation is clearly too simple, since the low rate of return of the PAYGO system may just be the mirror image of

the introductory gains of older cohorts which in 1957 were able to enter the system under overly favorable conditions. The PAYGO system is a device that redistributes wealth from later generations to introductory generations, but it may not essentially be an institution that wastes economic resources.

Once the introductory gains have been distributed in a PAYGO system, it may be difficult, if not impossible, to design a Pareto improving transition to a funded system. It is true that there is a burden imposed on later generations as shown by the rate of return disadvantage, but, unless the existing pension claims are negated, there may be no way to get rid of this burden and enjoy true efficiency gains.

Sinn (1997, p. 6, equation 1) has expressed this view in present value terms. He argues that “any pension system, be it PAYGO or funded or a combination of the two, is a zero-sum game for all the generations participating in the sense that the present value of all contributions equals the present value of all pensions” and he concludes that the feasible reform alternatives should be seen as devices for altering the time path of the burden imposed on later generations which are unable to reduce the size of this burden.² In the following, this interpretation will be extended and used to derive a number of equivalence results that may help illuminate the matter.

3. Implicit Taxes, Implicit Savings and Implicit Government Debt

Assume an overlapping generations structure where in period t there are N_t^y young persons who work and N_t^p pensioners who don't. The contribution to the PAYGO system of a young person is C_t and the per capita pension received by a member of the old generation is P_t . The

² The same interpretation has been given by Geanakoplos, Mitchell, and Zeldes (1998, pp.14-15, esp. fn. 17) and Wissenschaftlicher Beirat beim Bundesministerium für Wirtschaft (1998, pp. 19-20). Cf. also Sinn (1998).

two fundamental assumptions characterizing a simple PAYGO model are that contributions are fully used to finance the pensions in the same period,

$$(1) \quad N_t^y C_t = N_t^p P_t,$$

and that today's contributors are tomorrow's pensioners:

$$(2) \quad N_t^y = N_{t+1}^p .$$

The pension claims of the old generation should, as has frequently been argued, be seen as an “implicit government debt”:

$$(3) \quad D_t = N_t^p P_t .$$

The debt has to be serviced in a similar way to the explicit debt. The difference, however, is that servicing this debt with the contribution C_t generates a new pension claim against the next generation.

The claim against the next generation may or may not be overpaid with the contribution when compared with the price of a similar pension claim in the capital market. Call the part of the contribution that would have been sufficient to buy the PAYGO pension in the capital market “implicit saving”, S_t , and the remainder “implicit tax”, T_t :

$$(4) \quad C_t = S_t + T_t .$$

Obviously implicit saving is given by the equation

$$(5) \quad S_t \equiv \frac{P_{t+1}}{1+r_{t+1}},$$

where r_{t+1} is the rate of return offered by the capital market for an investment in t that generates a return in $t+1$. The implicit tax is defined according to (4) as a residual. It is the part of the contribution which would not have been necessary if the pension claim had been bought in the capital market and which is lost from the contributor's point of view.³

4. The Implicit Tax and the Internal Rate of Return

Consider first the relationship between the implicit tax and the internal rate of return of the PAYGO system. Let i_{t+1} denote the internal rate of return enjoyed by the pensioners of period $t+1$. As this rate is implicitly defined such that it makes a person's discounted pension equal to his contribution,

$$C_t \equiv \frac{P_{t+1}}{1+i_{t+1}},$$

Aaron's (1966) well-known equation

$$(6) \quad i_{t+1} = \frac{C_{t+1}N_{t+1}^y}{C_t N_t^y} - 1$$

which shows that the internal rate of return is given by the growth rate of the aggregate pension or contribution volume can be derived from (1) and (2).

³ See section 7.3 for a further discussion of this point.

Let

$$\tau_t \equiv \frac{T_t}{C_t}$$

indicate the implicit tax share in a person's contributions. Using (4), (5), (1) and (2) it follows that

$$\tau_t = 1 - \frac{C_{t+1}N_{t+1}^y}{C_t N_t^y (1 + r_{t+1})}$$

or, using (6) and rearranging terms,

$$(7) \quad \tau_t = \frac{r_{t+1} - \dot{i}_{t+1}}{1 + r_{t+1}} .$$

This equation says that a generation has to pay an implicit tax with its pension contributions if the internal rate of return provided by the PAYGO system – the growth rate of the aggregate pension volume - is smaller than the market rate of interest.⁴

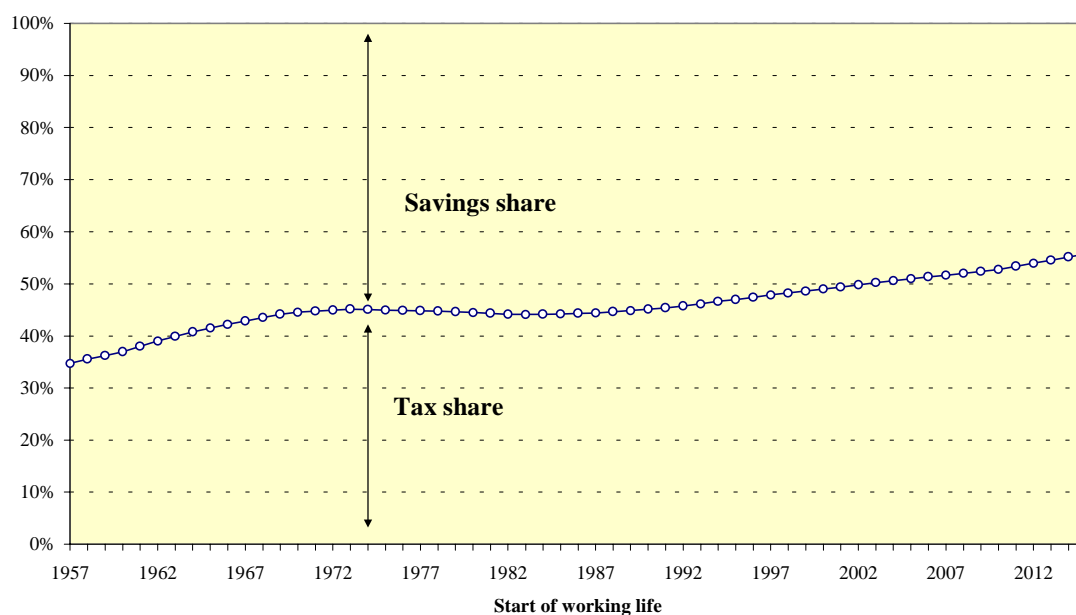
In the long run, the growth rate of aggregate pensions will certainly not be able to exceed the growth rate of GDP and the latter will be less than the rate of interest if the economy converges toward a steady state to the left of the golden rule point, as it must if an intertemporal general equilibrium with finite asset prices is to exist. Also, as was shown in figure 1 and observed by many authors, the internal rate of return of the pension system empirically tends to be much lower than the market rate of interest. Thus a positive tax share

⁴ Note that the two rates of return showing up in equation (7) do not refer to years but to generations which means that they are much higher than the respective annual rates. See figure 2 for the resulting size of the implicit tax rate.

should be considered the normal case. Nevertheless, it is clearly possible that generous pension reforms, which imply a sufficiently strong growth in the share of wages contributed to the pension system, make the growth rate of the contributions temporarily bigger than that of the sum of wages or GDP. In this case, the implicit tax could be negative for one or more generations, and the implicit saving could exceed the pension contribution.

How large is the implicit tax share under realistic conditions? The data used to construct figure 1 can also be used to calculate this share in the described annual cohort model for Germany which follows the spirit of the model presented here. The result is shown in figure 2.

Figure 2: *The saving and tax shares in the contributions to the German statutory pension system for cohorts with alternative starting years*



Source: CES

Obviously, the current German pension system has always been characterized by a positive tax share in the contributions for those who entered the system under regular conditions. The share was about one third for participants who entered the system at the age

of 20 in the foundation year 1957, but, with the passage of time, the situation has significantly deteriorated for the contributors. Today, new entrants must envisage that about 50 % of their pensions will be taxed away by the government to pay for the introductory gains made by those who were able to enjoy the benefits of the system without making the appropriate contributions. The situation will be even worse in future. The tax share in the contributions will rise towards 60 % in the second decade of the 21st century.

5. The Present Value of the Implicit Tax

How does the implicit tax relate to the implicit government debt? To answer this question, substitute for P_{t+1} in equation (5) according to (1) (where t is replaced with $t+1$) and multiply both sides of the equation with N_t^y taking account of equation (2). This gives

$$(8) \quad S_t N_t^y = \frac{N_{t+1}^y C_{t+1}}{1 + r_{t+1}}$$

or, when C_{t+1} is replaced according to (4):

$$(9) \quad S_t N_t^y = \frac{T_{t+1} N_{t+1}^y}{1 + r_{t+1}} + \frac{S_{t+1} N_{t+1}^y}{1 + r_{t+1}}.$$

Similarly it follows for any period $t + j$, $j \geq 1$, that

$$(10) \quad S_{t+j} N_{t+j}^y = \frac{T_{t+j+1} N_{t+j+1}^y}{1 + r_{t+j+1}} + \frac{S_{t+j+1} N_{t+j+1}^y}{1 + r_{t+j+1}}.$$

Inserting (1) and (4) into (3) gives

$$(11) \quad D_t = T_t N_t^y + S_t N_t^y,$$

which can be written as

$$(12) \quad D_t = T_t N_t^y + \frac{T_{t+1} N_{t+1}^y}{1+r_{t+1}} + \frac{S_{t+1} N_{t+1}^y}{1+r_{t+1}}$$

when (9) is used. The numerator of the last fraction on the right hand side of (12) can be replaced with $S_{t+j} N_{t+j}^y$ from (10) for $j=1$ and the same operation can be done with the numerator of last fraction on the right hand side of the resulting equation when $j=2$ is assumed, similarly for $j=3$ and so on. The result is

$$(13) \quad D_t = \sum_{j=t}^{\infty} T_j N_j^y R_j$$

where R_j is the discount factor for calculating the value in period t of a tax paid in period j :

$$(14) \quad R_j \equiv \prod_{k=t+1}^{k=j} 1/(1+r_k) \text{ for } j > t \text{ and } R_t = 1.$$

It is assumed that the elements of the sum in (13) converge which is the case if, beyond some finite time j , the implicit tax revenue grows at a rate that is smaller than, and bounded away from, each period's market rate of interest. As (7) reveals that this condition is basically identical with assuming that the implicit tax is positive, convergence can be assumed without any additional loss of generality.

Equation (13) reveals two useful propositions.

Proposition 1: *At each point in time during the existence of a PAYGO system the present value of the implicit taxes to be paid by all subsequent generations equals the value of the implicit government debt.*

The second proposition covers a special case of Proposition 1 and follows if it is noted that, according to (3), $D_0 = N_0^p P_0$:

Proposition 2: *The introductory gain of the first generation of retirees equals the present value of the implicit taxes that have to be paid by all future generations.*

Propositions 1 and 2 demonstrate the nature of the PAYGO system as a zero-sum game among the generations. They show that the burden imposed on the participants of an existing PAYGO system cannot necessarily be attributed to the inefficiency of the system, but may simply be a tax which is necessary to service the implicit government debt which was created with the gift to the first generation.

Note that servicing the implicit debt does not mean redeeming it. In fact, as (3) reveals that the implicit debt equals a generation's pension claims which typically grow from one generation to the next, it is clear that the debt will also increase with the passage of time. Thus the debt redemption is negative, which means that the implicit interest burden cannot be fully financed with the implicit tax and needs to be partially covered with new implicitly borrowed funds. Nevertheless, it is still true that the implicit debt equals the present value of all future implicit tax payments up to the very last cent.

6. The Transition Question

Let us now consider the transition problem which is at the center of today's policy debate about the pension problem. In principle, in the PAYGO system all future generations will participate in servicing the implicit debt created with the gift to the introductory generation. (Indeed, it follows from (7) and (6) that the implicit wage tax rate would even stay constant if the economy were on a steady state growth path where the market rate of interest is constant and where the contributions and the sum of wages grow at the same constant rate.) What happens to the tax burden when the PAYGO system is replaced with a funded system where a person's pension contributions are invested in the capital market so as to give this person a fair pension, one whose present value equals the investment outlay?

Since the existing pension claims will have to be respected and a person's contributions are fully used for his or her own pension, an explicit tax is necessary to finance the existing pension claims. A radical reform that maximizes the transition speed makes it necessary to impose the tax on the current working generation. The volume of this tax is equal to the implicit government debt and hence equal to the present value of the implicit taxes that would have been paid by all future generations had the PAYGO system continued to exist. In fact, this gives a straightforward result.

Proposition 3: *A rapid transition to a funded system makes it necessary to redeem the implicit debt immediately. Such a reform concentrates the tax burden implicit in the PAYGO system in one period, but does not reduce its size.*

Many authors have seen the difficulty of imposing a double burden on the transition generation and have therefore advocated a more gradual transition by using public debt as a smoothing device. Some part of the burden, it is argued, should be imposed on the current working generation and the rest should be financed with long term government debt to be

serviced by all future generations. Will this policy be able to reduce the present value of the tax burden?

To answer this question only a few formal steps are necessary. Let D_t^e and T_t^e denote the explicit government debt and the explicit tax used for servicing the debt per member of the working generation in period t . From the basic equation of motion

$$(15) \quad (D_t^e - T_t^e N_t^y)(1 + r_{t+1}) = D_{t+1}^e$$

it follows that

$$(16) \quad D_t^e = T_t^e N_t^y + \frac{D_{t+1}^e}{1 + r_{t+1}},$$

and in general it holds for arbitrary points in time $t + j$, $j \geq 1$, that

$$(17) \quad D_{t+j}^e = T_{t+j}^e N_{t+j}^y + \frac{D_{t+j+1}^e}{1 + r_{t+j+1}}.$$

Substituting D_{t+1}^e in (16) with the respective value that (17) gives for $j = 1$ one gets

$$(18) \quad D_t^e = T_t^e N_t^y + \frac{T_{t+1}^e N_{t+1}^y}{1 + r_{t+1}} + \frac{D_{t+2}^e}{(1 + r_{t+1})(1 + r_{t+2})}$$

and repeating this operation with D_{t+2}^e in (18) using (17) with $j = 2$ and so on with successively higher values of j results in the expression

$$D_t^e = \sum_{j=1}^{\infty} T_j^e N_j^y R_j$$

where R_j is again the market discount factor defined in (14) and where again a convergence of the discounted sum of taxes has to be assumed. This expression resembles (13) perfectly, and when $D_t = D_t^e$ is chosen, the following proposition is obvious.

Proposition 4: *A policy of converting the implicit debt into an explicit debt and distributing the burden of this debt over the future generations by means of an appropriate redemption policy will not result in a reduction of the present value of the tax burden. Whatever the chosen time pattern of the tax burden is, its present value is always equal to the present value of the implicit tax burden in the PAYGO system.*

It would even be possible to replicate the time paths of the implicit tax burden and the implicit debt in the PAYGO system exactly. This can be seen by developing the equation of motion for the implicit government debt. Deriving $D_{t+1} = N_{t+1}^y C_{t+1}$ from (1) and (3), inserting this expression into (11) while using (8), and rearranging terms yields

$$(D_t - T_t N_t^y)(1 + r_{t+1}) = D_{t+1}.$$

A comparison between this equation and (15) shows that a policy of equating the time path of the explicit tax with the one of the implicit tax in the PAYGO system will generate exactly the same time path for the government debt, too. Thus another result can be stated.

Proposition 5: *With an appropriate borrowing strategy it is possible to design a transition to a funded system which perfectly mimics the time paths of the implicit tax and the implicit debt in an ongoing PAYGO system.*

Given these results, the case for a transition to a funded system does not seem overwhelmingly compelling. Such a transition could change the time path of the tax burden, but not the burden itself. The PAYGO system distributes the financial burden resulting from the gift to the introductory generation evenly over all generations. Neither Musgrave's inter generation equity principle nor more sophisticated welfare arguments for tax smoothing suggest that it would be wise to shift this burden to the shoulders of the current generation as could be done with the introduction of a funded system.

Although these results do suggest some straightforward welfare implications, they should be interpreted with some caution since they have been derived from a partial analytic approach. While it was not necessary to assume a steady state, all present value comparisons were made given the time path of the market rate of interest. The exogeneity of the time path would be strictly justified in a small open economy, but not otherwise. In general, a redistribution of incomes between the generations will change the growth path of the economy and the time path of the marginal product of capital. The strict present value equivalence between the maintenance of the PAYGO system and the transition to a funded system will then no longer hold. The equivalence will only hold if the comparisons are made with the same set of factor prices. From a welfare perspective this is not as big a problem as it might appear at first sight. If the transition to a funded system is a lump sum redistribution between different generations, then the endogenous reaction of factor prices will not, in general, be able to generate a Pareto improvement. For such a possibility to occur it would be necessary for the impoverished generations to gain more from the endogenous change in factor prices than they lose by being burdened with an additional tax.

7. Three Equally Unconvincing Reasons for the Transition to a PAYGO System

Despite this result, it is not impossible to construct models of the transition from a PAYGO system to a funded system that predict genuine Paretian efficiency gains. However, the economic mechanisms responsible for such results may not always be closely related to the funded system as such and may also be available without the introduction of a funded system.

7.1. Capital Income Taxation

As was shown, the transition to a funded system can be used to concentrate the implicit tax burden in earlier periods of time. Under a variety of plausible assumptions that deviate from the plain Ricardian equivalence view, this would reduce private consumption in earlier periods and would hence increase aggregate savings and investment, thereby stimulating economic growth.⁵ More growth will not necessarily imply a welfare increase, given that there is such a thing as an optimal growth path. However, when the rate of return to real capital investment exceeds the households' rate of time preference and discount, the additional capital accumulation resulting from a transition to a funded system may increase the wealth and welfare of the economy.

One potential reason for a divergence between the rate of discount and the rate of return to capital is capital income taxation. Households equate their rate of time preference to the net-of-tax interest rate, and firms equate the marginal value product of capital to the cost

⁵ Among the possibilities one can list the following.

1. If the explicit tax is a consumption tax with a declining rate, households shift consumption to the future and increase their savings.
2. Households which are liquidity constrained and would like to borrow against future income, but cannot, will reduce their present consumption.
3. Households which save but make no bequests to their children, must react to the squeeze of their lifetime budget constraints and consume less during their lifetimes.
4. Concentrating the tax burden on earlier periods means redistributing it between long lived dynasties and short lived ones, whose chain of descendents is interrupted after the first or only a few generations. Since short lived dynasties have a higher marginal propensity to consume per period with regard to wealth transfers than long-lived dynasties do, this redistribution reduces aggregate present consumption and increases saving.

of capital which, in the presence of capital income taxation, exceeds the net-of-tax interest rate. The rate of interest in the above formulae, r , is in this case the net-of-tax market rate of interest, because it is this rate at which households can transfer resources to the future and at which the government can borrow. If the transition generates additional savings, this will not, at the margin and in itself, change private wealth or welfare, but it will give the government an extra tax revenue which could then be distributed to everyone. With this distribution, private wealth and private welfare would increase.⁶

While it would be possible to generate welfare gains in this way, these gains can hardly be attributed to the funded system. They would also be available by abolishing or changing the system of capital income taxation. For example, the introduction of cash flow taxation would completely eliminate the tax wedge between the marginal product of capital and the rate of time preference and induce an efficient speed of economic growth.⁷ In the presence of cash flow taxation, the extra growth generated by a transition to a funded system would not be welfare enhancing.

7.2. Risk Premia in the Stock Market

A similar argument applies to the relationship between the rate of return to bonds and to stocks. Normally, the rate of return that can be earned in the stock market is higher than the one that can be earned in the bond market. Since the latter is used for private and public discounting, an increase in saving that leads to a stock market investment will, it appears, increase private wealth and welfare.

However, this appearance could be deceptive, since an investment in stocks incurs more risk than an investment in bonds, and risk bearing in itself is a disadvantage for the households involved. Note that the extra return on stocks is not available with every

⁶ See Siebert (1988, p. 21) for an approach using this argument.

⁷ See Meade Committee (1978) and Sinn (1985).

investment, but on average only. It is a premium for risk taking. If the economy's price of risk taking is appropriately taken into account, the mere fact that stocks have a higher rate of return than bonds does not imply that an increase in investment would be a welfare improvement.

In order for a genuine welfare improvement to occur it would be necessary for funding social security to be combined with a better diversification of risks in the portfolios of wealth owners that reduces the risk premium more than otherwise would have been possible. Perhaps economies of scale in portfolio management will have such an implication. However, economies of scale cannot be counted as an argument in favor of a transition, unless it is demonstrated they could not be exploited in other ways, such as subsidizing investment funds and reducing legal entrance barriers to the stock market.

7.3. The Labor Leisure Distortion

In section 6 the pension system was modeled as an intergenerational redistribution device, and the contribution to the system was split into a saving share and a tax share where the latter was the necessary payment to compensate for the introductory gains. In fact, however, many pension systems are characterized not only by an intergenerational redistribution, but also by an interpersonal one among the members of the same generation. In the extreme case where the individual pension entitlement is independent of one's own contribution the full amount of this contribution may be considered a tax.

In this case, large distortions in the labor market must be reckoned with, since the full amount of the contribution drives a wedge between the marginal product of labor and the required marginal compensation of the employees. A transition to a funded system would abolish interpersonal redistribution and reduce the tax burden to the intergenerational redistribution component, provided it is combined with the establishment of individual accounts, as is commonly assumed. This is a potential for welfare improvements.

Again, however, this advantage has little to do with the funded system as such.⁸ For one thing, even a funded system could, in principle, be run on a collective basis, where a person's pension is unrelated to his or her saving. For another, individual accounts could easily be combined with the PAYGO system. Indeed, Germany has had such a system since 1957, and Sweden has recently moved further towards it. In Germany, a person's pension is almost proportional to his or her contributions,⁹ and this fact explains why black market activity is comparatively low in this country. Employees in Germany are eager to work officially, because they know that they can accumulate pension claims on their individual pension accounts.

When there are individual accounts, then the above analysis fits an individual's decision problem well. We simply have to assume that the contributions, taxes and savings introduced above are average values and that a person who makes x % of the average contribution will receive a pension which is x % of the average pension. In this case, the implicit tax share τ is a marginal, as well as an average, share in the contributions.

Assume that the individuals in the above model may differ and that

$$X_t = \int X_t(i) f(i) di \text{ for } X_t = P_t, C_t, T_t$$

where $X_t(i)$ is the pension, contribution, and tax, respectively, for an individual of type i , $f(i)$ is the frequency density function for the alternative types, and X_t is the corresponding

⁸ See Homburg (1990), Brunner (1996), and Fenge (1996, 1997) for illuminating discussions of this problem.

⁹ The degree of proportionality is not perfect insofar as the timing of contributions during one's lifetime and early retirement are not reflected in an actuarially fair manner. However, if A works in the same years and retires at the same point in time, but earns and contributes always twice as much as B does, he will also receive a pension which is twice as high as that of B. See Wrede (1999, this conference) for a welfare analysis of alternative earnings profiles in the context of a Pareto improving transition.

average over all members of the pension system. Suppose individual i 's contribution to the pension system in period t is

$$C_t(i) = c_t \alpha_t(i) w_t(i)$$

where c_t is the uniform contribution rate, $\alpha_t(i)$ is his labor supply and $w_t(i)$ is his wage rate.

Then it follows that individual i 's tax burden is given by

$$T_t(i) = \tau_t C_t(i)$$

and that the marginal and average tax burden on working time is

$$\frac{\partial T_t(i)}{\partial \alpha(i)} = \frac{T_t(i)}{\alpha(i)} = \tau_t c_t w_t,$$

where τ_t is still given by (7).

Given the time path of the market rate of interest, the model of sections 4-6 remains true regardless of these extensions. In particular, the present value of the implicit tax will continue to equal the present value of the explicit tax that would have to be raised under a funded system. It is true that a change in the time pattern of the tax burden that is typically associated with a transition (unless the case of Proposition 5 applies) would probably cause the time path of the average labor supply to react and would therefore change the time path of the labor tax base. However, if we allow for an appropriate adjustment of the tax rate, this would not affect any of the propositions derived above since they refer to the time path of the

implicit aggregate tax revenue rather than that of the tax rate. Thus, although the time path of labor supply may change after a transition, the present value of the labor tax revenue will have to cover the government debt implicit in the existing PAYGO system under all circumstances.

The welfare implication of this result is not trivial since it depends on whether or not the transition moves the time path of the wage tax rate, $\tau_t c_t$, closer to the welfare optimum, whatever that is. In principle, it is conceivable that there is a transition path towards a funded system which is accompanied by an appropriate prolongation of the transition via explicit public borrowing that generates welfare gains in the Kaldor-Hicks sense or as judged by an exogenously imposed intertemporal welfare function. However, a plain and rapid transition to a fully funded system is very unlikely to be such a transition path. On the contrary, the concentration of the inevitable wage tax burden on only one generation is probably not an optimal strategy, when reasonable assumptions are made about people's preferences or the properties of the intertemporal welfare function are made. As the excess burden of a tax is, to the first order of approximation, a quadratic function of the tax rate, a broad tax base is certainly preferable to a narrow one. A continuing PAYGO system has a very broad base which consists of the wage incomes of all subsequent generations. With a sudden transition to a funded system, the tax base is the wage income of one single generation only. Thus, under normal circumstances, it seems that the economy is much closer to the optimal labor tax path when the PAYGO system is continued than in the case where it is replaced with a funded system.

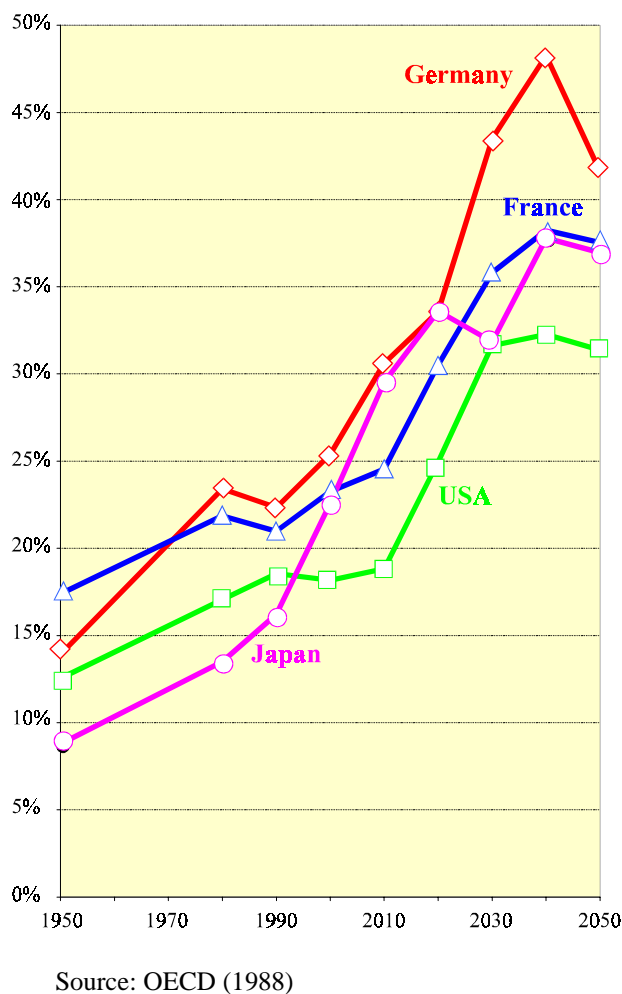
A reduction in the excess burden that results from the need to repay the implicit government debt is only conceivable if labor income as such is given up as the tax base. If a less distortionary tax than the labor income tax can be found, welfare improvements may, of course, be possible. However, this possibility does not really lend support to a transition to a funded system since, in principle, it might also be possible to find a better base for the contributions to the PAYGO system. If the labor income tax is part of an optimal tax system,

then a transition to a funded pension system is more likely to increase the labor leisure distortions rather than reduce them.

8. Another Reason for a Partial Transition to a Funded System

The previous sections could be understood as a plea for maintaining the PAYGO system, but, in fact, they are just a quest for better arguments for the introduction of a funded system. Despite the weakness of the efficiency arguments in favor of the funded system, funding might still be advisable, but the reason has little to do with the intertemporal equilibrium and efficiency arguments discussed so far. It relates instead to the imminent crises of the pension systems of the western world.

In most of the more developed OECD countries birth rates have declined considerably over the last few decades and medical progress is continually increasing life expectancy. The result is a sharp increase in the old-age dependency ratio, i.e. the ratio of people 65 years or over to the number of younger people 15 years and upwards. Figure 3 shows the problem for four typical countries, France, Germany, Japan, and the US. Within a century, from 1950 through 2050, the ratio increases roughly threefold. For every pensioner a member of the working age had to nourish in 1950, there will be three pensioners in 2050 if labor force participation and retirement conditions do not change.

Figure 3: *The old-age dependency ratio for four industrialized countries*

The figure shows that the situation is particularly severe in Germany. There the old age dependency ratio increases from 14 % to nearly 50 % within a century. The reason for this dramatic development is to be sought primarily in the changed fertility rates. In the last century, Germany had the third highest birth rate in Europe, now it has the third lowest one, only surpassed by Spain and Italy. Ten Germans have less than seven children over their lifetimes. Small wonder that the PAYGO system encounters serious problems.

The present German old-age dependency ratio will double, or more than double, up to 2035. Given the replacement ratio – the ratio of an average pension to an average wage income – this would mean doubling the contribution rate from the present 20% to 40 % of

wages, and, given the contribution rate, it would mean halving pensions in relation to working income. In 1992, the German parliament introduced substantial future pension cuts, but even they will not be able to prevent the contribution rate rising towards 30% in the crucial thirties of the next century. In any case, a major crisis of the pension system must be expected and this could shake the foundations of the state if no timely solution is found.

This is the case for a partial funding of the pension system. In the PAYGO system people expect to receive a pension from their children, but, as there are not enough children, they need a second source for their pension. Savings invested in the capital market could be such a source. If retirees receive a pension from their savings in addition to receiving one from their children, they can avoid over-burdening their children and nevertheless secure a decent life in old age. Of course this implies a burden for them during their working lives which they would not have had to bear without the demographic crisis, but it avoids the risk of over-burdening their children. Given that there is an inevitable pension burden, it may be wise to distribute it to as many shoulders as possible.

It is true that, with such a solution, today's working generation would have to bear a double burden because they have to nourish the old with their PAYGO contributions and to finance part of their pensions themselves. However, if the cause of the pension crisis is taken into account, there is nothing strange or unusual in this double burden that would provide an argument against funding the pensions.

In order to be able to consume in old age and enjoy a decent retirement life, a working generation has to save or to raise children who will later be able to pay them a pension. Or, to put it more bluntly, the working generation has to invest in *real* or in *human* capital. If it does not invest in either real or in human capital it will have to starve because nothing breeds nothing. It has always been the case, and will never be otherwise, that the working generation has to bear a double burden: raising children and paying for the old. Today's working generation has preferred not to raise as many children as previous generations did. This is the

reason for the pension crisis. Given that they saved the education expenses and caused the crisis, they may well now be asked to invest the free money in the capital market instead of spending it on additional consumption. It is true that the investment for their own pension is a double burden, but it is the same double burden which they would have had to bear with a continuous development of the population anyway.

Obviously, this philosophy is very different from the efficiency arguments in favor of funding pensions that one finds in the literature. Instead of some fundamental intrinsic inefficiency, it is the demographic crisis itself that calls for the funding. If the economy were on a steady state growth path where a typical family's number of children stayed constant from one generation to the next, the transition from a PAYGO system to a funded system would impose a triple burden on the working generation: paying for the old, paying for their children and paying for their own pension by investing in the capital market. However, given that the crisis results from the working generation's choice to lower their child raising expenses, the additional saving does not involve such a triple burden.

This has important implications for the desirable volume of funding. While the efficiency arguments tend to imply a full transition to a funded system, the philosophy explained here can only lend support to partial funding. Funding with real capital is needed only to the extent that "funding" with human capital is lacking. More than that is not necessary and will even be detrimental, since it would indeed result in a triple burden. People's total expenses for the PAYGO system, for the funded system and for child raising could be as high today as they otherwise would have been in the thirties of the next century, and the pension crisis would start right away.¹⁰

¹⁰ According to calculations carried out at CES for the Council of Advisors to the German Ministry of Economics, a full and unmitigated transition to a funded system would immediately raise the sum of PAYGO contributions and the necessary saving to a good 28 % which is also the forecast for the contribution rate in an unchanged PAYGO system for the year 2035.

9. Concluding Remarks

Politicians want to be right, but scientists want to right for the right reason. This preference explains why most of the space of this paper was devoted to a discussion of the “wrong” reasons. It was shown that the PAYGO pension system is not, in its essence, an inefficient insurance device that absorbs economic resources, but a zero-sum game between the generations. In present value terms, there is nothing to be gained from a transition to a funded system even though the latter offers a permanently higher rate of return. The sum of the implicit and explicit tax burdens that result from the need to respect the existing pension claims is the same under all systems and transition strategies.

This statement had to be qualified in the presence of capital income taxation, risk premia and a consideration of an endogenous labor leisure choice, but nevertheless these modifications were seen not to lend any particular support to the transition from a PAYGO system to a funded system.

The “true” reason which was offered in the last section of the paper is arguably pragmatic, but it deals with the imminent crisis of the pension systems which no clear thinking person can overlook. Where human capital is lacking, and to the extent that it is, real capital could be used to fill the gap. It may not be unreasonable to ask those who have saved on human capital to use their funds to provide real capital instead.

This philosophy was shared by the Council of Advisors to the German Ministry of Economics who used it to postulate a partial transition to a funded system. The calculations ordered by the Council revealed that an initial savings rate of 4.5 %, which would later be reduced so as to keep the overall contributions constant, would be sufficient to accumulate enough funds up to the third and fourth decades of the next century to cover $\frac{1}{4}$ of the old age pension expenses. The Council recommended that the PAYGO part of the pensions be curtailed accordingly so that the sum of the funded and the non-funded pensions equals the pension claims as defined by the German pension law.

With some modifications Germany's new labor minister Riester has followed this advice. However, he faced such strong opposition to the idea of enforcing the necessary savings that he had to withdraw his plan. This shows how meaningless the scientific discussion, including the one given in this paper, is for the policy making process. Not even a benevolent minister is allowed to care about things that will happen in only a few decades from now.

References

- Aaron, H. (1966): "The Social Insurance Paradox," *Canadian Journal of Economics and Political Science* 32, 371-374.
- Börsch-Supan, A. (1998): "A Public Pension System on the Verge of Collapse," in: H. Siebert (ed.), *Redesigning Social Security*, Mohr Siebeck: Tübingen.
- Breyer, F. (1989): "On the Intergenerational Pareto Efficiency of Pay-as-you-go Financed Pension Schemes," *Journal of Institutional and Theoretical Economics* 145, 643-658.
- Brunner, J. K. (1996): "Transition from a Pay-as-you-go to a Fully Funded Pension System: The Case of Differing Individuals and Intragenerational Fairness," *Journal of Public Economics* 60, 131-146.
- Feldstein, M. (1995): "Would Privatizing Social Security Raise Economic Welfare?" *NBER Working Paper* 5281.
- Feldstein, M., and A. Samwick (1998): "The Economics of Prefunding Social Security and Medicare Benefits," in: H. Siebert (ed.), *Redesigning Social Security*, Mohr Siebeck: Tübingen.

- Fenge, R. (1996): "Pareto-Efficiency of the Pay-as-you-go Pension System with Intergenerational Fairness," *Finanzarchiv* 52, 357-363.
- (1997): *Effizienz der Alterssicherung*, Physica: Heidelberg.
- Geanakoplos, J., O.S. Mitchell, and S.P. Zeldes (1998): *Would a Privatized Social Security System Really Pay a Higher Rate of Return?* NBER Working Paper 6713.
- Homburg, S. (1990): "The Efficiency of Unfunded Pension Schemes," *Journal of Institutional and Theoretical Economics* 146, 640-647.
- Kotlikoff, L., K. Smetters, and J. Walliser (1998): "The Impact of Transiting to Privatized Social Security," in: H. Siebert (ed.), *Redesigning Social Security*, Mohr Siebeck: Tübingen.
- Meade Committee (1978): *The Structure and Reform of Direct Taxation*. Report of a Committee chaired by Professor J. E. Meade (The Institute for Fiscal Studies), Allen & Unwin: London.
- OECD (1988): *Reforming Public Pensions*, OECD Social Policy Studies No. 5.
- Siebert, H. (1997): "Pay-as-You-Go versus Capital-Funded Pension Systems: The Issues," in: H. Siebert (ed.), *Redesigning Social Security*, Mohr Siebeck: Tübingen.
- Sinn, H.-W. (1985): *Capital Income Taxation and Resource Allocation*, North-Holland: Amsterdam, New York etc.
- (1997): *The Value of Children and Immigrants in a Pay-As-You-Go Pension System: A Proposal for a Partial Transition to a Funded System*, NBER Working Paper 6229, Cambridge, MA.
- (1998): "Comment on Axel Börsch-Supan," in: H. Siebert (ed.), *Redesigning Social Security*, Mohr Siebeck: Tübingen.
- Wissenschaftlicher Beirat beim Bundesministerium für Wirtschaft (1998): *Grundlegende Reform der gesetzlichen Rentenversicherung*, Bundesministerium für Wirtschaft, Studienreihe No. 99: Bonn.

Wrede, M. (1999): *Pareto Efficient Pay-as-you-go Pension Systems with Multi-Period Lives*,
Paper presented at the 55th IIPF Congress, Moscow, 23-26 August 1999.